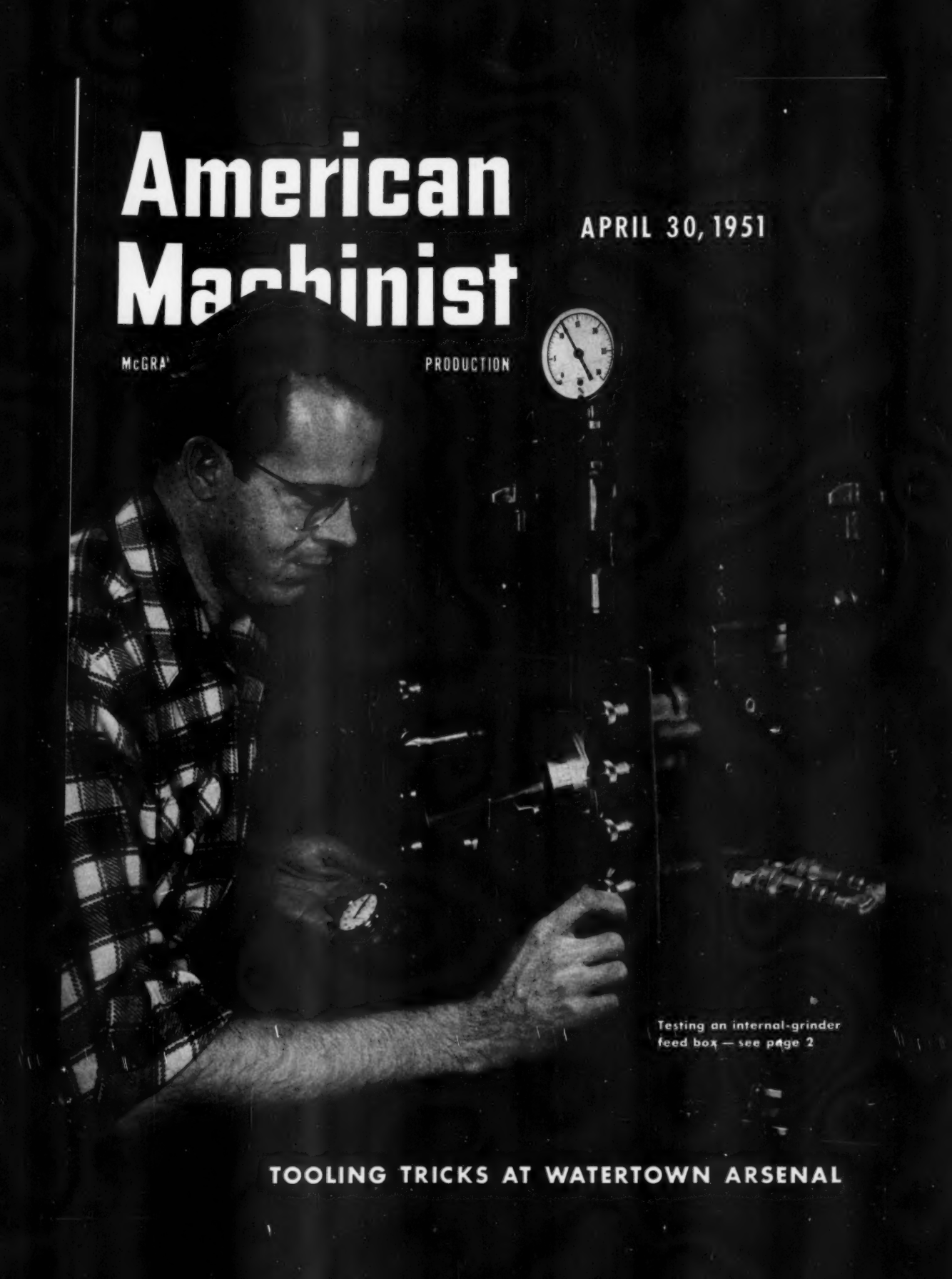
American Machinist

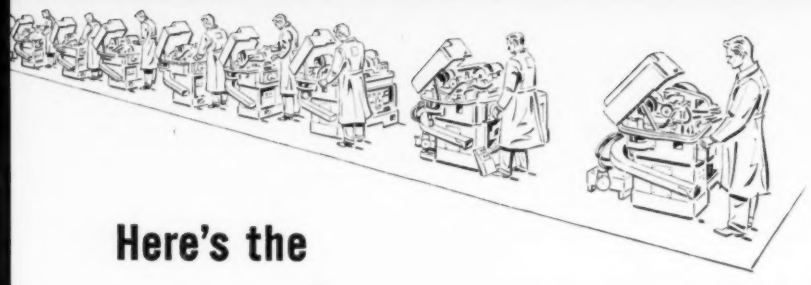
APRIL 30, 1951

McGRA' PRODUCTION



Testing an internal-grinder feed box — see page 2

TOOLING TRICKS AT WATERTOWN ARSENAL



Here's the proving ground*

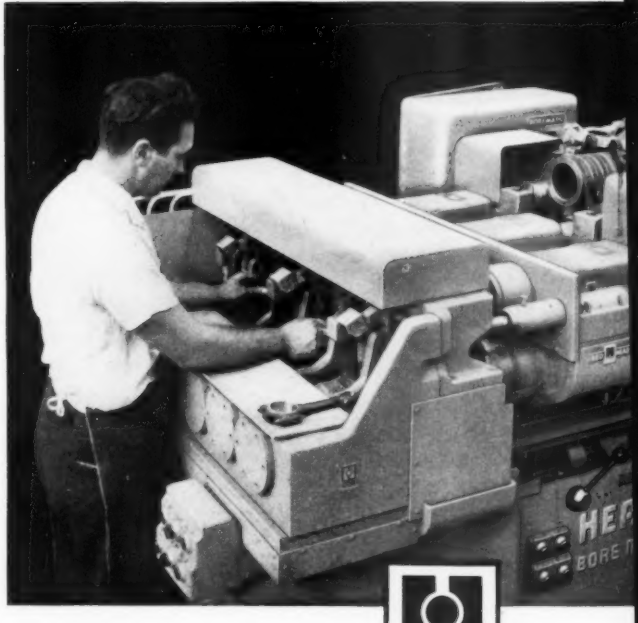
for the extra performance that you get in every Heald Machine

* *Run-off test on a* Heald Model 426 Bore-Matic with six-station work-holding fixture for finishing automotive conn rods. The operator loads three parts while three others are being borized—eliminating handling time and substantially improving production.

Heald's "on-the-job" test floor is the proving ground for higher precision and faster, easier production — the end result of the extra care and precision that go into every step of manufacture of every Heald Bore-Matic and grinding machine. The results speak for themselves.

You *know* exactly what your new Heald machine will do — before it leaves the plant. For your production line actually starts on the Heald run-off floor. Here your new machine precision finishes the parts which you produce, to the required specifications and at the specified rates of production — or *better!*

Remember—when it comes to precision finishing, it pays to come to Heald.



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American Machinist

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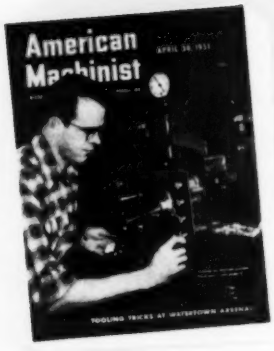


Chips and QUIPS

Testing Feed Box . . . An operator performs a combination of inspection and run-off operations on a Heald internal-grinder feed box, in our cover Kodachrome. Each knob must be calibrated and checked for accuracy of setting and operation under correct hydraulic pressure before assembly on the machine. The unit utilizes the Heald method of constant-feed throttling, in which speeds and feeds remain constant regardless of temperature change.

Heald celebrated this month its 125th anniversaary.

Ultrasonics . . . Some months ago, we finally received a rough manuscript on a subject we've been digging at for years: ultrasonics. We went to a number of companies the author suggested and got such examples as were available of actual applications of high-frequency sound in Metalworking. Here's the story—a sort of Special Report in miniature—outlining theory and showing authenticated applications in soldering, honing, feeding a machine table, and the like.

Carbide Milling . . . A. O. Schmidt, research engineer for Kearney & Trecker (see biography) has put down for us a series of notes on recent carbide-milling tests and unusual jobs. He shows how used die blocks can be refinished efficiently, explains how milling speed and feed must be coordinated for the particular job to assure economical tool life and desired finish. He also describes a production-milling setup on steel at 2500 fpm—almost twice the highest speed recently reported, and about four times conventional speeds.

Quality Control . . . In utilizing new shop principles, it is frequently as important for a shop man to know what won't work as what will. Dr. James V. Strella, staff statistician at Thompson Products, Inc., tells this kind of story. Training and administration are the keys to success. Here are answers for those planning a system and those who are trying to make one work.

Vanes . . . We feel it is important, occasionally, for everyone to de-cobweb the part of his brain devoted to the mathematics of really tough shop problems. Our current de-cobwebber deals with cutting large mixed-flow impeller vanes. No regular machine was available, so Alex Hammer figured out how to use a Jigmil for the job. Here are details of the development at DeLaval Steam Turbine Co.

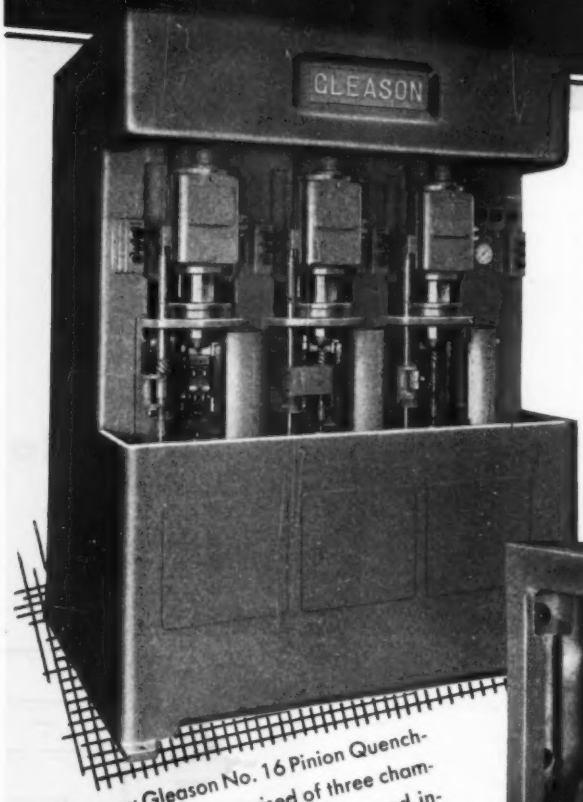
Tooling Tricks . . . Three special setups devised to do jobs at low cost, without special equipment, at Watertown Arsenal are described by E. L. Pearson, chief of manufacturing there. One is boring in a lathe only slightly longer than the piece, the second is cutting a groove with a contoured bottom inside a small bore, and the third is belt-polishing a small piece for directional graining to avoid stress concentrations in service.

Chug Guard . . . R. P. Vahldieck of Harley-Davison has described unusual lever-action dies for forming unusual parts — motorcycle guard bars. The story, for your better understanding, is told principally in pictures.

Coming . . . *AM* for May 14 will include the second of our Special Reports on threading (thread chasing, Mar. 5), this one dealing with tapping. Again, it will be a comprehensive compendium . . . There will also be articles on modern production-control methods, on a special age-hardener for aluminum, a jet-blade polisher, an unusual drilling and reaming arrangement for fuel-atomizer nozzles, another Volkert die, on welding, and on figuring the economics of replacing a particular machine. The cover will depict, in full color, extrusion of a steel propeller blade.

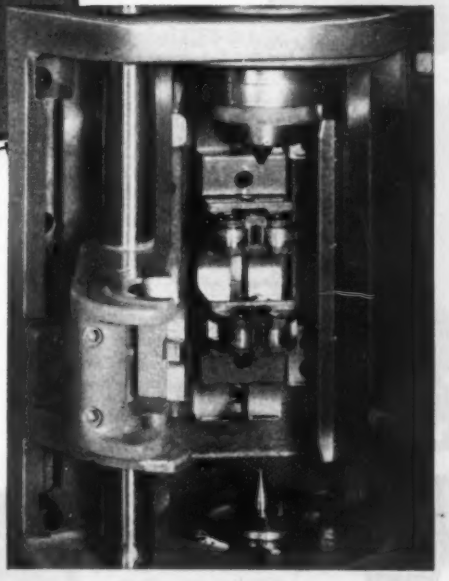
RESEARCHER . . . Dr. A. O. Schmidt, research engineer, Kearney & Trecker Corporation, Milwaukee, is familiar by his works to AM readers. He was a mechanical engineer for ten years with Carl Zeiss Optical Works, then came to this country. He took graduate work under Professor Boston at the University of Michigan, taught production engineering at Colo. State College, U. of Ill., and Marquette. He has written a number of articles on his research work, is a member of the ASTE, ASME, and Sigma Xi. The photograph was taken by Harold Francke.

COMPLETELY AUTOMATIC PINION QUENCHING



WITHOUT DISTORTION

An entirely new design for pinion quenching . . . with each individual unit operating independent of the others to assure continuous fast production of *straight* hardened pinions . . . simple to operate . . . completely automatic . . . this machine eliminates distortion . . . further straightening of shafts becomes unnecessary.



The new Gleason No. 16 Pinion Quenching Machine is comprised of three chambers. Each pinion may be hardened independent of the others through a completely automatic operation from the time the pinion is placed into the loader jaws until it has been rotated on centers against rollers during quench and returned to unloading position.

BUILDERS OF BEVEL GEAR MACHINERY · FOR OVER EIGHTY-FIVE YEARS · GLEASON

Write for more information on this modern way of pinion quenching.

GLEASON WORKS

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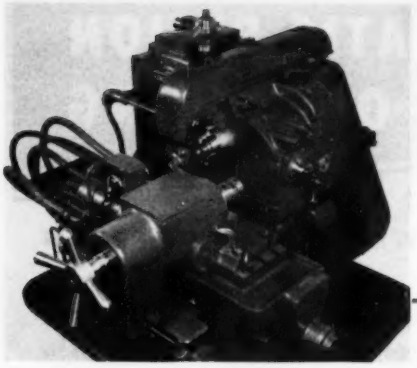
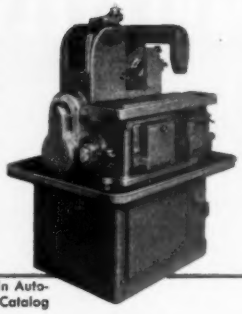
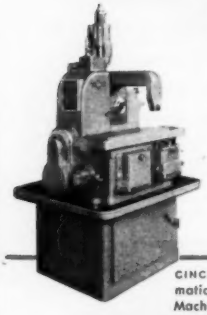


Hydraulic fixtures can be readily applied to CINCINNATI No. 0-8 Automatic Milling Machines. In this example, a hydraulic rotary milling fixture is mounted on the table of an 0-8 Plain, to form mill grooves on the O.D. of two sizes of saw shanks. Cutting speed . . . 300 feet per minute. Feed rate . . . approx. 15" per minute. Production . . . 175 per hour.

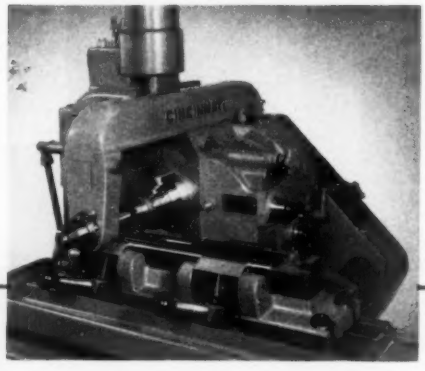


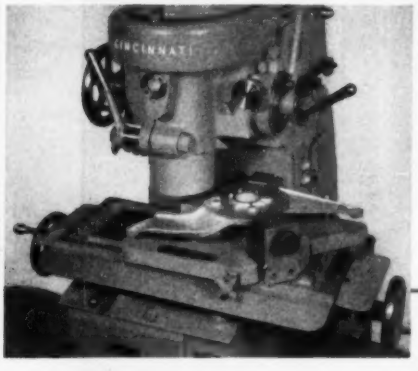
CINCINNATI No. 0-8 Plain Automatic Milling Machine. Catalog No. M-1607.



Jumping the cutter over obstacles or taking two or more cuts in line are specialties of CINCINNATI No. 0-8 Rise and Fall Automatics. These characteristics are employed to advantage in milling two keyways in steel shafts. Both keyways are milled in one cycle. Feed rate . . . spindle carrier and table, 10" per minute. Production . . . 101 per hour.

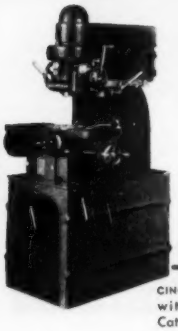
CINCINNATI No. 0-8 Automatic Rise and Fall Milling Machine. Catalog No. M-1607.





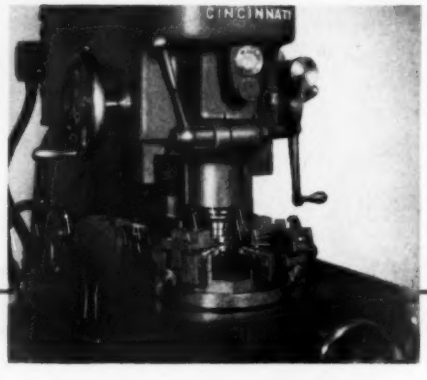
120 per hour . . . A high speed carbide milling operation on a CINCINNATI No. 0-8 Vertical. The part is an aluminum brake shoe support. Operation . . . mill bottom. Cutting speed . . . 730 feet per minute. Feed rate . . . 21¾" per minute (special feed rate).

CINCINNATI No. 0-8 Vertical with conventional table feed. Catalog No. M-1532-1.



530 per hour . . . CINCINNATI No. 0-8 Vertical with Rotary Table, tooled up for an unusually high production job of milling bevels on the end of firing pins. Cutting speed . . . 620 feet per minute. Feed rate . . . 1.28 rpm of table.

CINCINNATI No. 0-8 Vertical with Rotary Table Feed. Catalog No. M-1199-2.



RELIEF FOR SHOPS

about to burst their production seams

There's more than one way to increase production. While materials for expansion are in tight supply, look into the advisability of using smaller and more productive machine tools. And if you find possibilities in the idea, your best choice for milling operations will be the CINCINNATI 0-8 line.

There are four styles of 0-8's:

1. No. 0-8 Plain Automatic
2. No. 0-8 Automatic Rise and Fall
3. No. 0-8 Vertical, conventional table traverse
4. No. 0-8 Vertical, rotary table traverse

The horizontal style machines have very rapid automatic table cycles, started with one lever. Features include automatic backlash eliminator (for down-milling cuts), and automatic spindle stop (to safeguard the operator). Vertical style 0-8's do not have automatic table cycles, but they can be tooled up for rapid production, as illustrated here; they are equipped with adjustable stops and micrometer adjustment of spindle quill and ram; one man can often run two machines. ¶ A few examples of the type of work handled by these efficient, hard-working machines give you an idea of the way in which they fit into your production schedule. Complete information may be obtained by writing for literature. Condensed data appears in Sweet's Catalog File for Mechanical Industries.

THE CINCINNATI MILLING MACHINE CO. CINCINNATI 9, OHIO

CINCINNATI

CINCINNATI

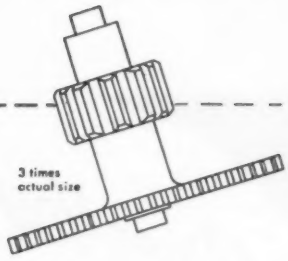
MILLING MACHINES • CUTTER SHARPENING MACHINES
BROACHING MACHINES • FLAME HARDENING MACHINES
OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

SPECIFICATIONS AND MATERIAL	PRODUCTION PERFORMANCE	LIMITS MAINTAINED
• PINION 64 diam. pitch 20° pressure angle 14 teeth .2187" pitch diam. .125" face width	80 pieces* per hour per machine @ 1200, 3/16" strokes per minute	.0005" composite error tooth to tooth .001" total composite error
• GEAR 64 diam. pitch 20° pressure angle 40 teeth .625" pitch diam. .045" face width	58 pieces* per hour per machine @ 2000, 3/32" strokes per minute	.001" eccentricity tolerance
• MATERIAL cold rolled steel B-1113	*50% higher output could be attained with less stringent limits	

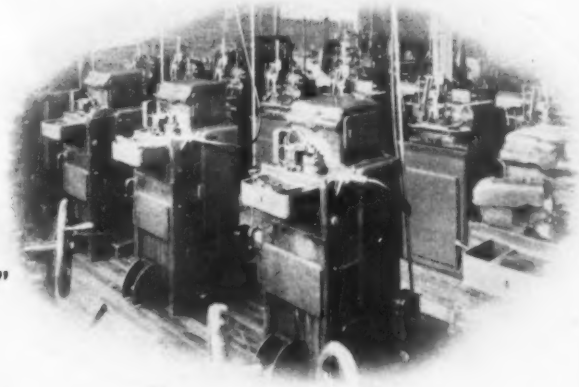
GEAR SHAPERS
SHAVING MACHINES
THREAD GENERATORS
CUTTERS AND SHAVING TOOLS
GEAR INSPECTION INSTRUMENTS

PLASTICS MOLDING MACHINES

64-PITCH GEAR TEETH



to .0005" Limits at Low Cost



Production on a battery of Fellows 3-inch Fine-Pitch Gear Shapers held to "cruising speed" to maintain finest quality at all times

Instrument Gear Works in Chicago is a specialist in high quality instrument Gears. They have good reason to be proud of the customers they serve and the efficiency with which the required fine-pitch gear precision is maintained. The tabulation on the facing page is a typical performance.

The background of accuracy control at Instrument Gear Works is reliance on a group of Fellows Fine-Pitch Gear Shapers tooled with 64-pitch Original Fellows Cutters.

If you have a fine pitch or small gear job you owe yourself a thorough investigation of what can be obtained in both speed and accuracy from this Fellows 3-inch machine. We'll be glad to tell you where there are machines at work in your territory. Write the office nearest you.

Fellows

THE FELLOWS GEAR SHAPER COMPANY • Head Office and Export Department • 78 River Street, Springfield, Vermont.
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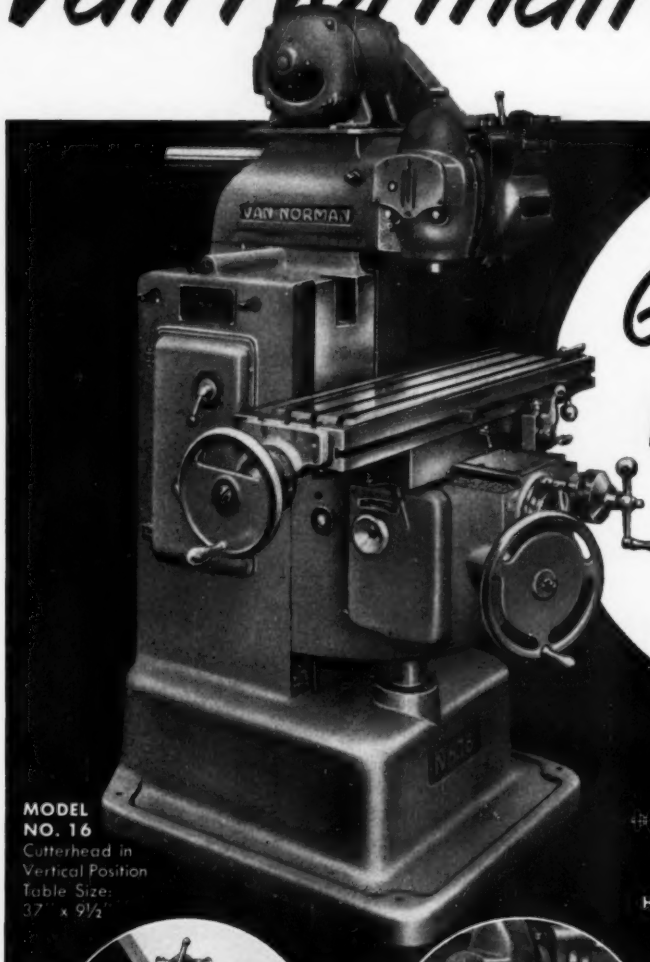
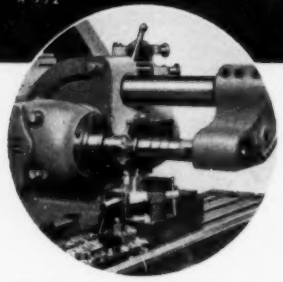
Van Norman No. 16

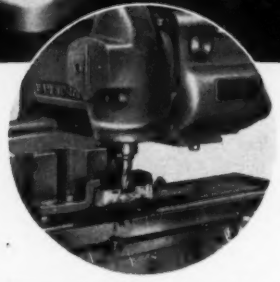


Gives You the Workability of Three Machines

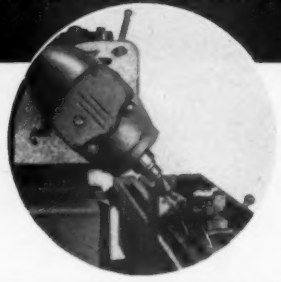
MODEL NO. 16
Cutterhead in Vertical Position
Table Size:
37" x 9½"



With the cutterhead locked in horizontal position, the No. 16 is used for horizontal milling operation. Hardened stop set at factory assures positive 0° setting.



Illustrated, the No. 16 is used for a vertical milling operation. Permanently fixed hardened stop permits easy, accurate positioning of the cutterhead at 90°.



Here the adjustable cutterhead is set at 45° angular milling position. Horizontal, vertical, or angular milling all are easily performed on the No. 16 Miller.

Ram Type Miller

Here's a miller so versatile that it enables you to perform any and every milling job from horizontal to vertical . . . simply by positioning the adjustable cutterhead which is mounted on a movable ram. Why do you benefit . . . because with this one machine you have the work range of several single purpose millers. This enables you to keep the Van Norman miller working all the time . . . also many jobs can be carried through to completion without changes in the workpiece setup — saving time and reducing errors.

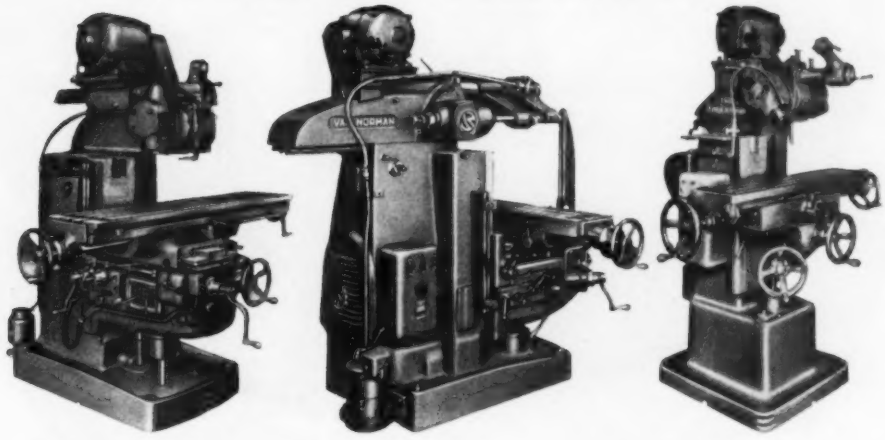
The Van Norman No. 16 Ram Type Miller gives you these additional advantages —

Conveniently grouped controls in front of knee makes operations easy. Power feeds are selected with a quick change feed selector. Large, easy-to-read dials.

Built-in electric controls simplify operation. Single lever selector controls spindle, feed and coolant. Push-button, on front of knee, starts and stops motors as pre-selected.

Rugged base and column, massive cutterhead, large ram and heavy knee, saddle and table assembly provide maximum rigidity and long life accuracy.

OTHER VAN NORMAN RAM TYPE MILLERS THAT REDUCE PRODUCTION COSTS



MODEL NO. 38
Cutterhead in Vertical Position
Table Size: 64" x 14"

MODEL NO. 22L
Cutterhead in Horizontal Position
Table Size: 45" x 10"

MODEL NO. 12
Cutterhead in Angular Position
Table Size: 37½" x 9 3/16"

VAN NORMAN COMPANY
SPRINGFIELD 7, MASSACHUSETTS

AUTOMOTIVE LANDIS

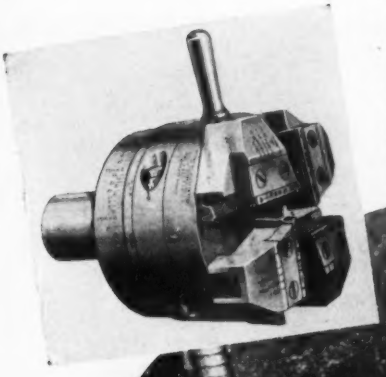
Packard Motor Car Company—Hardened and Ground LANCO Head on LANDMACO Leadscrew Precision Threading Machine cutting a 1" 14 pitch thread 3/8" long on end of a main shaft. Output—150 per hour, floor-to-floor.

The LANDIS Machine

WAYNESBORO • PENNSYLVANIA

PARTS threaded by DIE HEADS...

Packard and Kaiser-Frazer are two of the many automobile manufacturers using Landis Die Heads to produce threads on automobile parts. In the mass production of parts to be used in a continuous line final assembly, accuracy is as important as high output. Landis Die Heads consistently have been high production tools on a wide variety of operations. At the same time they produce threads to meet the most rigid specifications. The virtual elimination of "down time" on Landis Die Heads is another feature that makes them well adapted to mass production operations. For information, write for Bulletins F-80 & F-90.



Kaiser-Frazer, Willow Run Plant—⅝" F Type LANDMATIC Head cutting a ⅝" 18 pitch National Fine thread ½" long on a steering worm end. Output—100 per hour, floor-to-floor.

CO.

U. S. A.

NEW LANDIS TOOL precision grinder

for large diameter work pieces

type CHW universal grinder

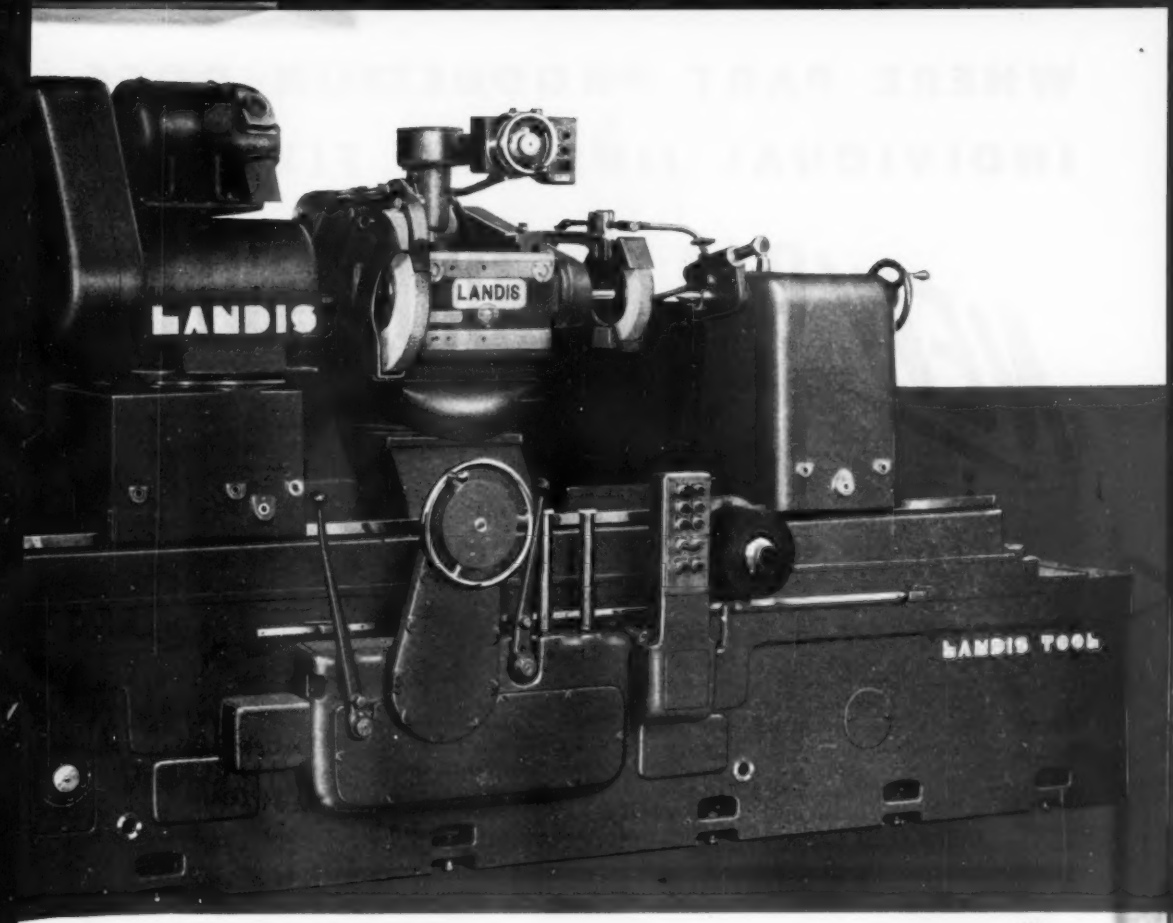
This new and versatile grinder is used for the precision grinding of many light parts with large diameters such as turbo-jet rotors, motor armatures, water valves and track carriers.

Standard sizes available are:

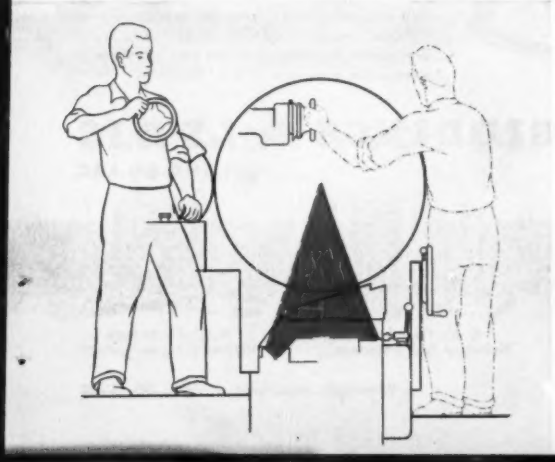
30" x 48"
30" x 72"
30" x 96"
30" x 120"
36" x 48"
36" x 72"
36" x 96"
36" x 120"
48" x 48"
48" x 72"
48" x 96"
48" x 120"

LARGE RIBBED T-SLOT FACE PLATE—For holding work pieces not suited to between centers grinding.

DUAL OPERATING POSITIONS AVAILABLE—Rear operation shown. Diagram shows front and rear operating positions.



EXTRA-WIDE CARRIAGE WAYS INSURE STABILITY—Load distribution triangle shows how wide spacing gives stability to work carrying members.



LANDIS TOOL
Precision Grinders

LANDIS TOOL COMPANY

WAYNESBORO, PENNA., U. S. A.

WHERE PART PRODUCTION DOES INDIVIDUAL JIGS AND FIXTURES

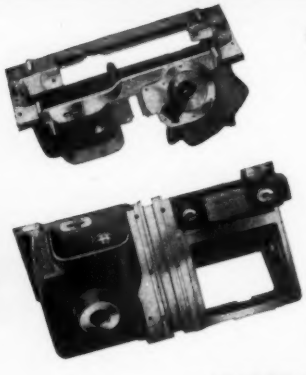
NEW G&L MEDIUM DUTY MACHINE

RAPIDLY PERFORMS PROFILE MILLING, DRILLING, TAPPING AND PRECISION BORING OPERATIONS ON IMPORTANT TRANSMISSION GEAR CASE

Costly fixtures for handling various machine and equipment components can be eliminated when the new G. & L. 300 series machine is used for vital precision machining operations. The problem of producing parts to meet delivery schedules is greatly reduced by placing work on this flexible, high-speed machine. No time is lost in tooling up for a job requiring only a minimum number of parts. Work is placed directly on the machine for a wide range of operations. These are performed quickly and easily, for G. & L. machines are designed to complete work at high rates of speed. Or should your work be large and awkward, the versatility of this machine makes it possible to handle such jobs as the parts illustrated with equal efficiency.

You Can Solve Production Problems Easier

. . . call in experienced Giddings & Lewis engineers who will be glad to submit correct machining recommendations. There is no obligation for this service.

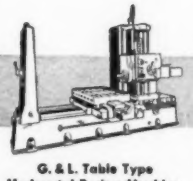


Check These Complicated Parts Machined Without Fixtures on a G. & L.

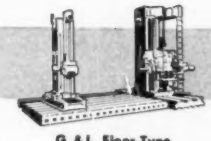
More than 75 contour milling, drilling, boring, reaming, tapping, slotting and back facing operations are completed as this casting is indexed on a simple, trunnion-type holding block. Providing jigs and fixtures for such a complicated part in the limited quantity needed proved too costly and time consuming. Yet, complete machining was standard and accepted work for a G. & L. Your own similar machining problems may be as easily solved with advanced G. & L. machines.

GIDDINGS & LEWIS
FOND DU LAC

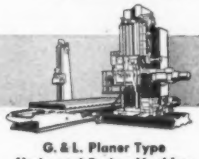
G&L HYPRO



G. & L. Table Type Horizontal Boring Machine

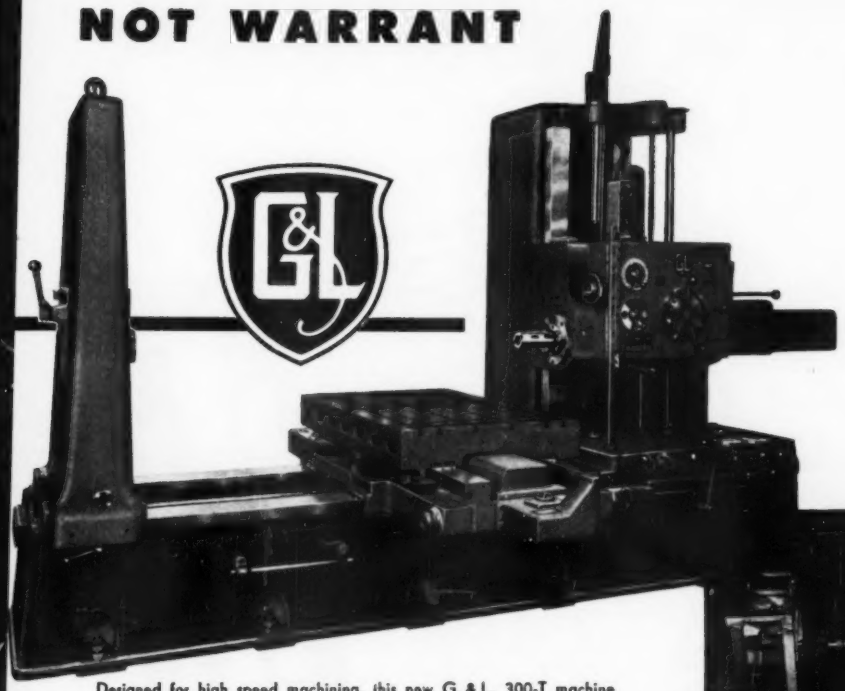


G. & L. Floor Type Horizontal Boring Machine



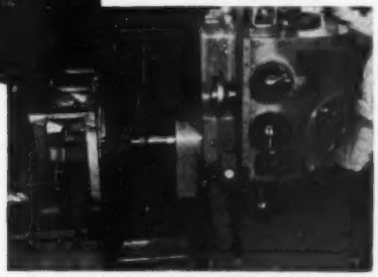
G. & L. Planer Type Horizontal Boring Machine

NOT WARRANT

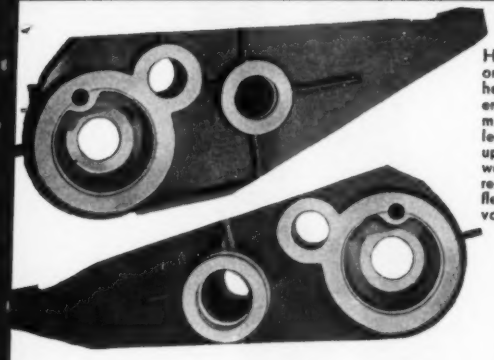


Designed for high speed machining, this new G. & L. 300-T machine has a speed range from 7 to 1600 R.P.M. and a feed range (inches per rev.) of .0012-.125. Numerous advanced features such as pendant control, simple direct reading dials, built-in scales and verniers, and conveniently located operating levers make this machine valuable wherever progressive machining practices are followed.

Operating convenience lessens worker fatigue adding to productive output. Here a transmission case casting is being bored.



Photograph Courtesy Armstrong-Blum Mfg. Co., Chicago, Ill.

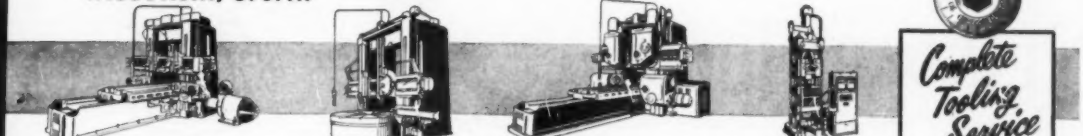


Here is a different type of gear case machined on a G. & L. Bore center distances are readily held to ±.0004". In this instance, precision end measures and dial indicators are used, making it possible to obtain tolerances equivalent to those of a jig borer. You can depend upon a Giddings & Lewis machine to perform work to required limits and at the same time receive the multiple advantages of machine flexibility and versatility in producing a broad variety of parts.

Alignment of bearing bores are held to ±.0005" without difficulty, thus insuring proper meshing of gear train when this transmission is assembled.

MACHINE TOOL COMPANY

WISCONSIN, U. S. A.



Cincinnati Hypro Double Housing Planer

Cincinnati Hypro Vertical Boring and Turning Mill

Cincinnati Hypro Planer Type Milling Machine

G. & L. Vertical Plastics Injection Press

DAVIS — Complete Tooling Service

When you need *Speed!*

OF COURSE this picture is a long way from machine shop practice. The point is—

Fast production is built into "Red Shield" Drills. This is verified by their selection for use in mass production of all kinds of goods. You will find them specified and used by the major producers in the automotive, aviation, farm equipment, railway, home appliance and electrical industries.

Design, construction and workmanship insure uniform operating characteristics, reduce delays due to tool failure and result in fast, economical production. For sale coast to coast by leading Industrial Supply Distributors.

STANDARD TOOL CO. 3950 CHESTER AVENUE CLEVELAND 14, OHIO

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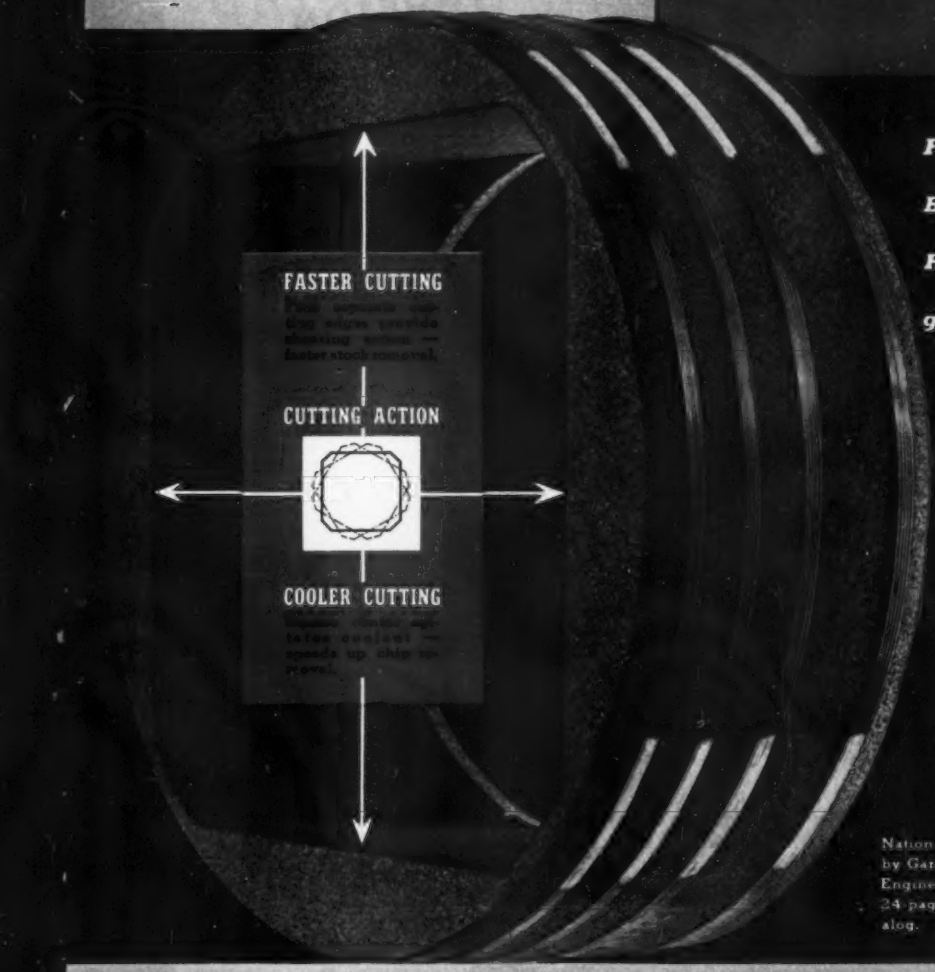
THE STANDARD LINE: *Drills • Reamers • Taps • Dies • Milling Cutters • End Mills • Hobs • Counterbores • Special Tools*

NEW SQUARE CENTER
Brings Flat Surface Grinding Costs Down

GARDNER
abrasive discs



For Pratt & Whitney, Blanchard, and Hanchett type grinders

Nation-wide service by Gardner Abrasive Engineers. Request 24-page abrasive catalog.

101A

GARDNER WIRE-LOKT ABRASIVE DISCS

full range of types and sizes

GARDNER MACHINE COMPANY

410 Gardner Street • Beloit, Wis.

WHAT IS THE NEW NORTON PROCESS?
Developed and installed by Norton engineers in a new 5-acre plant, it is a streamlined, precision process that produces grinding wheels to a degree of uniformity never before thought possible. The process involves production equipment and quality control methods that assure the uniformity of all mixing, molding, firing, and finishing operations. The result: uniform structure, inherent balance and grinding efficiency unmatched in the entire abrasive field.

YOUR TOOLROOM GRINDING COSTS

with the most uniform wheels ever produced!

Only Norton *New-Process* Wheels Give You All 3 Advantages

1. BUILT-IN BALANCE reduces vibration in operation. The wheel hugs the work. You can grind to closer tolerances and smoother finishes. No more chatter marks! What's more, this balance is inherent. It stays for the life of each wheel.

2. MORE UNIFORM STRUCTURE means consistent grinding action throughout each wheel and from wheel to wheel . . . more even wear for longer life . . . fewer machine adjustments . . . less risk of tool spoilage . . . assurance that all wheels with identical markings will give you the same top-grade performance.

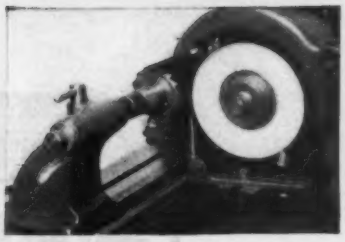
3. FASTER, SMOOTHER, MORE EFFICIENT CUTTING ACTION comes from the right selection of the various Norton abrasives plus the features of the *new process*. These wheels allow deeper cuts in expensive, heat-sensitive high-speed steel and cast alloy tools without drawing their temper. They also stay sharp longer . . . make frequent dressings unnecessary . . . a big saving in time and toolroom grinding costs.

RUN A TEST! If you haven't already standardized on Norton *New-Process* Wheels in your toolroom, run a comparative test right away. Your nearby Norton distributor or representative will help you select from the several types of Alundum* abrasives the wheels that will cut your costs on any tool grinding job.

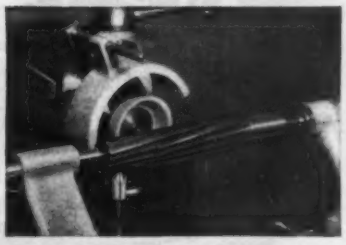
NORTON COMPANY, Worcester 6, Mass.
Warehouses in 5 cities. Distributors in all principal cities.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES
Making better products to make other products better



YOU SAVE TIME sharpening spiral milling cutters with Norton *New-Process* Alundum Wheels because they stay sharp and hold their size much longer than ordinary wheels.



YOU REDUCE SPOILAGE in backing off reamers with Norton *New-Process* Alundum Wheels because their free, cool cutting action does not draw the temper.

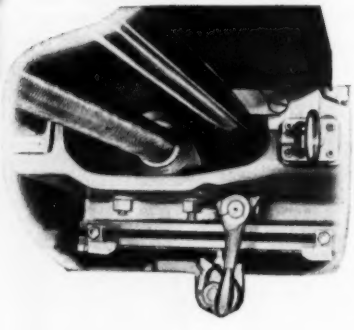
YOU GET CHATTER-FREE FINISHES when you use Norton *New-Process* Alundum Wheels on your toolroom surface grinders because their built-in balance makes them run smoother.

YOU GET ALL THE FACTS about lowering toolroom grinding costs in this 162-page handbook on Toolroom Grinding. Write for your free copy of FORM 835-1C

SMOOTHER FEED

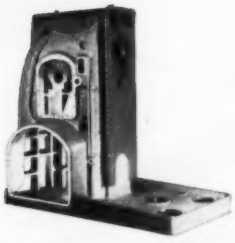
A new line of Knee-Type Milling Machines

KEARNEY & TRECKER MILWAUKEE **CK's**

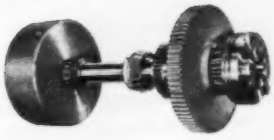


YOU'LL get the smoothest feed performance ever on Kearney & Trecker's new CK milling machines. Why? Because these CK's have a new design, heavy duty, 2" diam. table feed screw rotating through an extra-long table feed nut — giving you more bearing contact. That means smoother power feed. Add the positive-acting backlash eliminator and you get CK's smoother, more effective climb milling. What's more, the separate motor drive for table feed is interlocked with the spindle drive motor for overload protection. No danger of stalling cutters in cut. But smoother feed is only one of many pace-setting CK features. Look at all the others. You'll see why CK's are the most productive, profitable milling machines you can buy today — anywhere!

Replacement of obsolete machine tools is an



GREATER RIGIDITY — Yes, these new CK columns are the most rigid milling machine columns we've ever designed! They give you 1000 pounds more metal scientifically distributed in heavier ribbing, box section, sponson construction . . . to effectively absorb vibration from heaviest cutting loads.

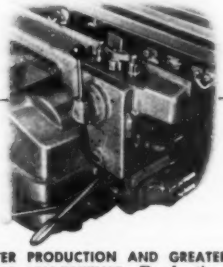


GREATER CUTTING EFFICIENCY — Added momentum of spindle-mounted flywheel assures longer cutter life and greater efficiency, through smoother, more positive drive — a key to most efficient use of modern cutting tools. Spindle rigidly supported by Kearney & Trecker's original 3-bearing design.

GREATER ADAPTABILITY — No. 60 Heavy Duty drive flange on Nos. 4, 5 and 6 machines enables use of heavy duty arbors with flange drive for large single or multiple cutter setups; or bolting large face-milling cutters directly to spindle nose. Average setups use standard arbors with No. 50 spindle drive.

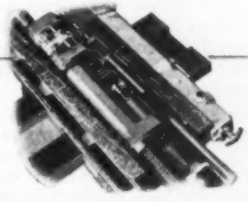
NON-GLARE RAPID-SET DIALS—You'll avoid costly errors in reading and setting these new micrometer dials. They're vapor blasted to give you a satin surface with high contrast markings. They're easy and quick to set and provide positive lock at every setting.

FEEDS AND SPEEDS TO TAKE FULL ADVANTAGE OF MODERN CUTTING TOOLS — and you really can do it with the broad feed and speed ranges on Kearney & Trecker's new CK milling machines. You get 24 spindle speeds (15 to 1500 rpm on Nos. 2 and 3, 13 to 1300 rpm on Nos. 4, 5 and 6) with Kearney & Trecker's automatic protecto-mesh shift to eliminate gear clashing. And there's the extra-wide feed range — 32 changes from ⅜" to 90" per minute—with separate 3 or 5 hp feed and rapid traverse drive.



GREATER PRODUCTION AND GREATER OPERATING CONVENIENCE—Production men will like Mono-Lever Control because it reduces idle cutter time, shortens floor-to-floor cycle time on both long and short run lots. Operators will like it because it makes faster, simpler, less fatiguing work for them.

GREATER HORSEPOWER — where you need it. That's what you get with new CK independent motor drives for spindle and for feed and rapid traverse. Depending on machine size (Nos. 2, 3, 4, 5 or 6), machines range from 10 to 25 hp for spindle drive and 3 to 5 hp for feed and rapid traverse.



GREATER MACHINE LIFE — through automatic lubrication and generously proportioned gears and shafts throughout for overload conditions. There's a forced flood system in the column and knee, and a positive metered, pressure pump system for table, saddle and knee ways, and table feed assembly.

Kearney & Trecker's new CK line of knee-type machines is designed to meet every demand of present-day milling . . . making them more accurate, and MORE PRODUCTIVE for you. Contact your Kearney & Trecker representative or write direct to obtain their complete specifications. Find out how CK machines easily replace obsolete machines at substantial savings to you. Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.

KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS

investment that makes Dollars and Sense.

Why the sea is salty

IN Norse mythology, a poor man got a magic mill from the elves. With it he could grind whatever he wanted--food, clothing, furniture, and best of all, gold. Of course, the poor peasant's lot changed from poverty to riches.

An envious brother borrowed the mill. He commanded it to "grind herrings and broth and grind them good and fast." But having taken the mill in such haste, he didn't know the magic words to shut it off. He was almost drowned in broth when the brother came to the rescue.

Finally, the magic mill was stolen by a salt dealer, who put it on his ship. Safely at sea, the skipper demanded, "Grind salt and grind it good and fast." Alas, he hadn't learned the control words either. The mill ground salt endlessly, filling all his kegs and his hold, covering the decks and at last sinking the ship. There at the bottom of the sea, so people say, the magic mill still grinds--and that's why the sea is salty.

From time immemorial, men have dreamed about magic mills and schemes to bring abundance and riches. Here in America, today, there are plans that are flooding us with superabundance of certain commodities. But what about the magic words to shut off the mill?

Isn't it time we see the truth in this ancient Norse myth, that "too much" is just as foolish as "too little?" We may well remember this first law of economics: In a *free* market, supply can adjust itself to demand--whether it be potatoes or steel--without sinking the ship. Here is a must job for all thinking Americans.

QUALITY · YOUNGSTOWN · SERVICE

The Youngstown Sheet and Tube Company

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Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

RAILROAD TRACK SPIKES - CONDUIT - HOT AND COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RODS - SHEETS - PLATES.

YES, YOU CAN GET MORE PRODUCTION WITH SAFETY OUT OF YOUR PRESENT POWER PRESS EQUIPMENT WITH

THE

V&O

FEED-O-MATIC POWER PRESS FEEDER

Installed on Any Make Press for Secondary Die Operations

Faced with the problem of getting more production out of your present power press equipment? What you need is a V & O Feed-O-Matic Power Press Feeder!

Scores of users will tell you: The V & O Feed-O-Matic increases secondary die operation production up to 50% . . . 100%, and higher, *with safety!*

The V & O Feed-O-Matic increases die life, too. Because of the "precision touch" with which it picks-up each blank to feed it *accurately* to the die, and the way it automatically trips the press.

Easily and quickly installed on any make power press, the V & O Feed-O-Matic requires no special dies . . . can feed small pieces two-at-a-time to double dies . . . and can be set-up for new work in one hour, or less.

Deliveries Are Favorable

FREE BOOKLET

Write today for your copy of the illustrated Feed-O-Matic booklet, which gives you full details, including specifications.

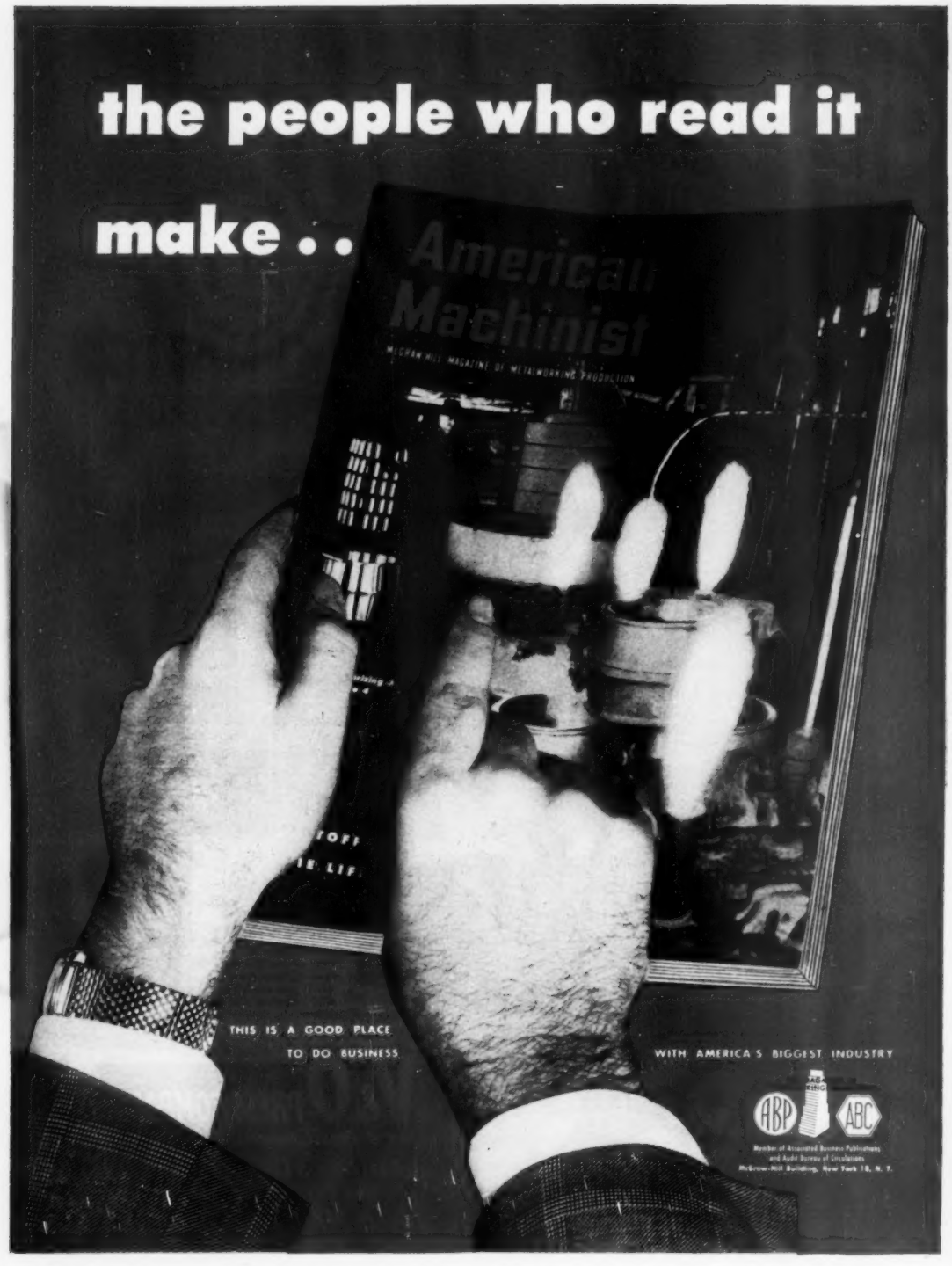
THE V&O PRESS COMPANY

DIVISION OF EMHART MANUFACTURING COMPANY

Builders of Precision POWER PRESSES and FEEDS

Since 1889 **HUDSON, N.Y.**

the people who read it make . .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McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION
THIS IS A GOOD PLACE TO DO BUSINESS
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. . . . one of the world's great selling forces*

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Year after year, advertisers invest more advertising dollars in American Machinist than they invest in any other magazine serving America's biggest industry: METALWORKING . . . the industry which manufactures every machine, appliance, automobile, airplane or other metal product, and annually accounts for over one-third of *all* industrial output.

Our nearest representative can give you abundant facts to show you why these advertisers do invest so heavily in *American Machinist*. Among the most important are:

The people who read American Machinist . . . and the reason why they do.

The people who read it . . . with the voluntary, self-generated enthusiasm wise advertisers seek . . . are over 28,000 management-concentrated, production-minded men. The reason they read it, and pay to do so 100%, is that this *only* magazine *edited exclusively* for metalworking production executives gives them more job help than they can get anywhere else.

American Machinist puts unmatched editorial power behind any product which can help Metalworking produce $100 billion of machinery, equipment, and appliances this year. And *American Machinist* is the *only* metalworking magazine which offers you the unquestionable, completely unbiased *proof* of readership you'll find in the Advertising Research Foundation's first survey of a metalworking magazine.

Over 600 advertisers can tell you:

American Machinist is the place to concentrate your advertising for top sales in America's biggest industry. Why buy less . . . when *only* *American Machinist* delivers the most in Metalworking . . . and does so at lowest cost?

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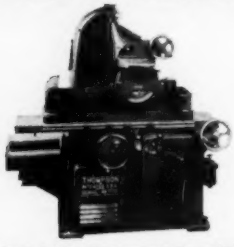
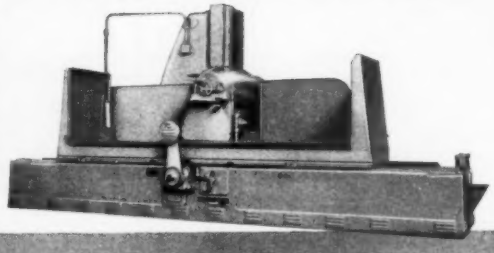
Save Time and Money ... Select

THOMPSON

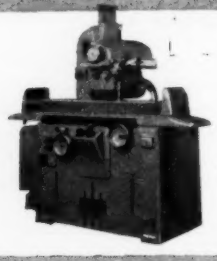
HYDRAULIC SURFACE AND CONTOUR GRINDERS



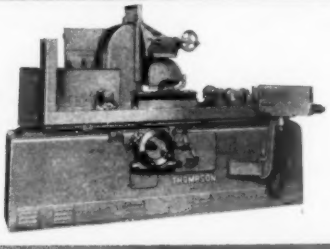
TYPE B Small General Purpose Grinders sizes from 4x12x18 to 12x12x120



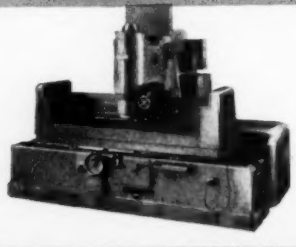
TYPE C & CX Medium and Heavy Duty Grinders sizes from 12x16x60 to 36x36x240



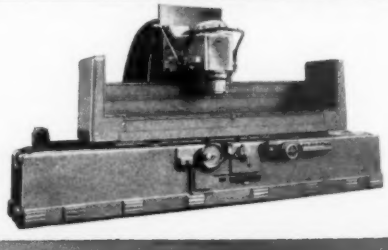
TYPE F Tool Room Grinders available in sizes 6x10x18 and 8x10x36



TYPE B & C TRUFORM Contour Grinders for all shapes sizes 8Bx12x30 to 16x16x54



FIXED COLUMN VERTICAL SPINDLE Production Surface Grinders sizes 12x18x36 to 60x84x180



SLIDING COLUMN VERTICAL HYDROVERT For abnormal or multi-level surfaces sizes 16x30x40 to 42x120x192

Write Thompson today for details . . .

1 **WIDEST RANGE** of light and heavy duty Surface and Contour Grinders

2 **HIGHEST ACCURACY** for lower costs

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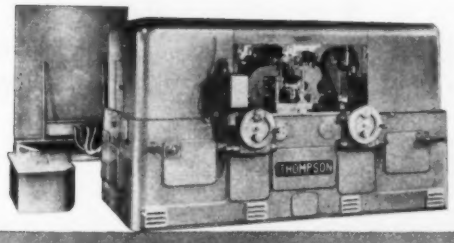
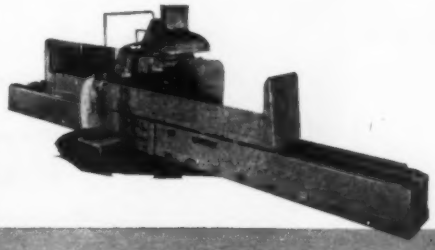
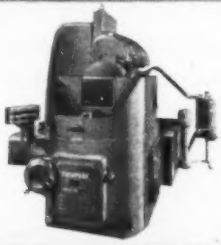


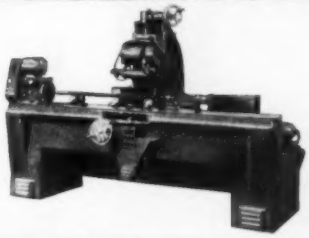
DOUBLE WHEEL BUCKET AND BLADE GRINDER for jet aircraft



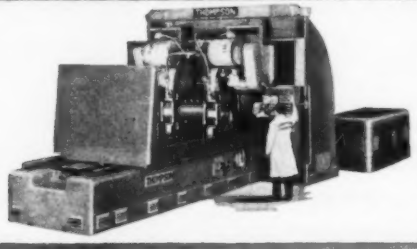
WAY GRINDERS Many sizes and types from 18x118 to 96x360



TWIN CHUCK ROTARY GRINDER For grinding circular metal discs 6 to 18 inch and 6 to 24 inch sizes



NEW SERIES 600 MANUAL BROACH GRINDER sizes 4x48 to 6x96



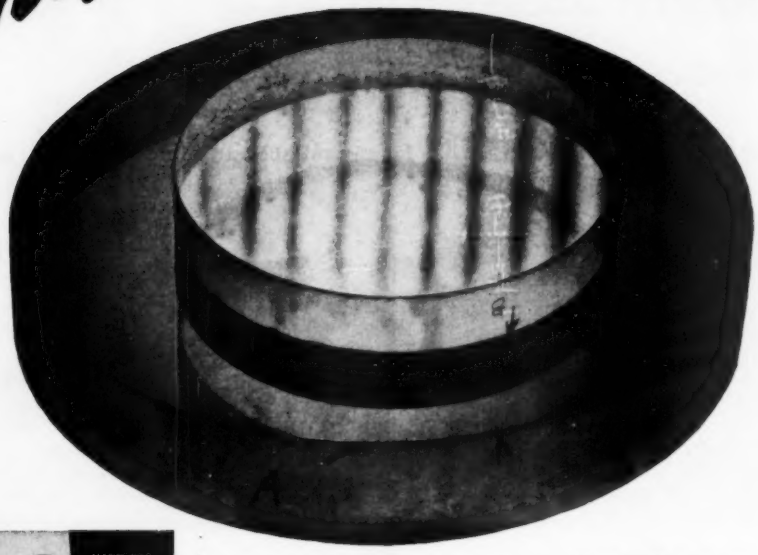
RAIL TYPE HYDRAIL Widest grinder ever built sizes 60x240x96 to 72x360x240

Thompson SURFACE Grinders

The Thompson Grinder Co., Springfield 1, Ohio

Van Keuren OPTICAL FLATS
are the proof of Precision

BOSTON



NEW YORK

Detecting worn spot on amplifying gage anvil.

Checking flatness of lapped shoulder on a shaft with a special 3" diameter x 29/32" hole Fused Quartz Optical Flat.

IF the 10" diameter Van Keuren Master Flat shown above were extended from New York to Boston, the surface would deviate from a true plane less than 1".

Insist on having Van Keuren Fused Quartz Optical Flats. They are beautifully finished and are of superlative accuracy on both sides. They are the best buy.

IF YOU HAVE A PROBLEM

of testing flat surfaces, send us a sample part for examination and report.

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THIS 208-page volume represents 2 years of research sponsored by the Van Keuren Co.

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92 hrs. of heat treatment

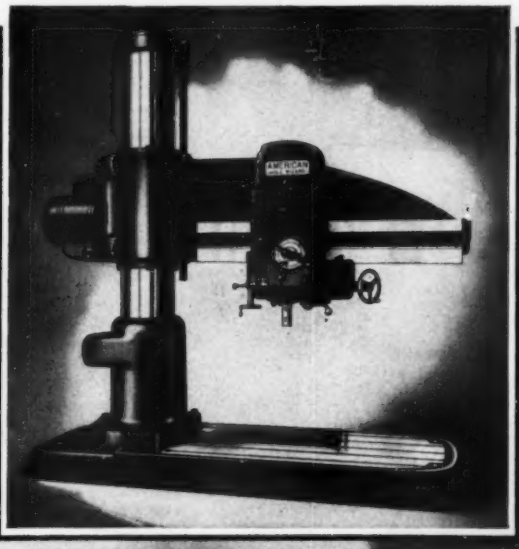
. . . required to produce the ultimate in radial drill spindles

"AMERICAN" Radial Drill Spindles are made of nitralloy. 20 hours of heat treatment from rough to finish, then 72 hours of nitriding are required to produce the wear-resistant spindles used in these radials.

Both the spindles and sleeves are nitrided to 110 degrees scleroscope. This is harder than some grades of cemented carbide. The sleeve is finish honed and the spindle ground and then diamond lapped to a sliding fit in the sleeve. Because of the lack of affinity between these two hard surfaces the clearance between them may be reduced to the very minimum, which in this case is .00025".

This results in the greatest possible stability, resulting in an ideal construction especially for accurate boring operations, which demand a high degree of smoothness and rigidity of the spindle.

This is but one of the super features that make the "AMERICAN" Hole Wizard an outstanding investment.



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Lathes and Radial Drills

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With all the work there is to be done today -- can you afford to waste manpower on inefficient machines? The New Britain-Gridley Division, The New Britain Machine Company, New Britain, Conn., U.S.A.
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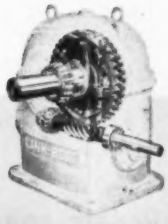
Speed reduction problem?

Is it Ratio? Space? Shock? Overload?

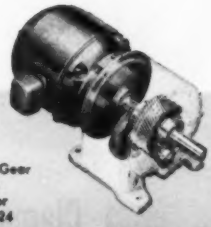
No *one* speed reducer solves *every* reduction problem. That's Why LINK-BELT Builds All THREE.

FOR the *right* speed reducer engineered to match your exact conditions, your best bet is Link-Belt. Link-Belt builds all three—Helical, Herringbone and Worm Gear Drives. When a Link-Belt power transmission engineer analyzes your problem, he isn't tempted to fit his recommendation to a limited line.

You can also be sure that the Link-Belt unit recommended is engineered and built for tough operating conditions. And efficiency in power transmission is matched by flexibility in application!

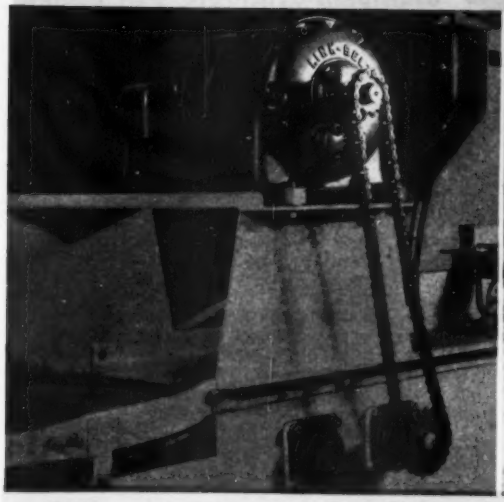


On Worm Gear Drives write for Book 2324

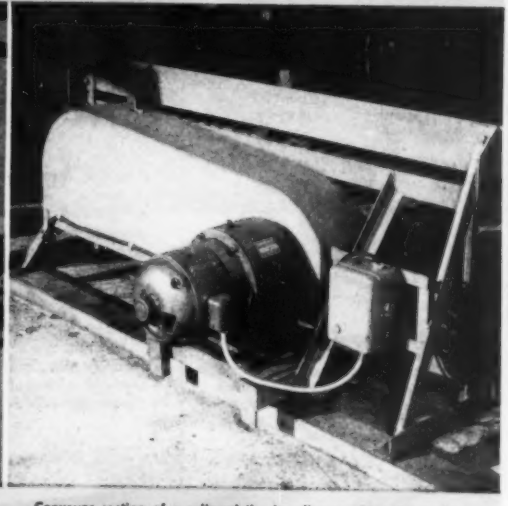


On Helical Gear Drives write for Book 2247

On Herringbone Gear Drives write for Book 2419



Link-Belt 1 hp Gearmotor, conveniently mounted, operates a revolving plate disc used in manufacturing tin cans. Note also Link-Belt Roller Chain and Roller Bearing Flanged Block.



Conveyor section of a railroad tie doweling machine driven by a compact Link-Belt 2 hp Gearmotor through an enclosed Link-Belt Precision Steel Roller Chain Drive.

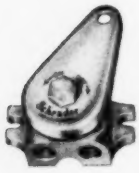
LINK-BELT

ENCLOSED GEAR DRIVES

12,502-A

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices, Factory Branch Stores and Distributors in Principal Cities.

Schrader Valves—Practical answers to air control problems



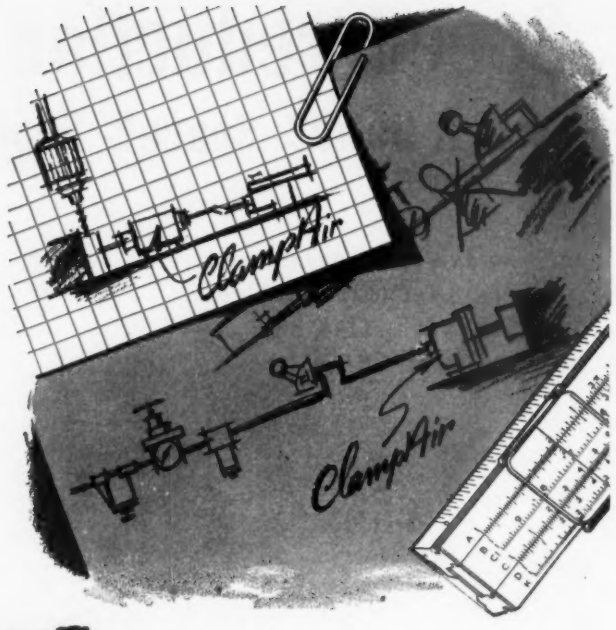
Three Way Valve—This inexpensive valve will give long service and is designed to operate small bore single acting cylinders such as the Schrader ClampAir. The stainless steel lever is functionally designed for positive stops and facilitates comfortable hand operation. A small hole in the lever provides means for mechanical operation if desired.

Valves With Hand Lever (Two, Three and Four-Way Types) Durability and simplicity of construction feature these forged brass valves which are designed for easy hand operation. One hardened steel bolt holds the two-piece body and internal parts in place and contributes to time-saving, low-cost maintenance.

Valves With Mechanical Lever (Two, Three and Four-Way Types) This type valve is similar to the one described above but has a lever arranged for mechanical actuation to provide automatic operation. The rugged steel lever will stand up under rapid actuation over long periods of use.

Air Cylinders • Operating Valves • Press & Shear Controls • Air Ejection Sets • Blow Guns • Air Line Couplers • Air Hose & Fittings • Hose Reels • Pressure Regulators & Oilers • Air Strainers • Hydraulic Gauges • Uniflare Tube Fittings

Schrader
PRODUCTS
CONTROL THE AIR



ClampAir cylinders can simplify any work holding operation

You can eliminate the tiring muscular work of setting mechanical clamps, as well as reduce the time for clamping with the new Schrader ClampAir.

It is actually a bantam-size air cylinder, with sufficient power to hold the work firmly in place for as long as you want... with the same force every time. Once you start using the Schrader ClampAir for your holding operations, not only will your productions be increased but rejects will be fewer.

Various types of machines, such as Drill Presses, Milling Machines, Gluing Devices and many others, are natural locations for Schrader ClampAirs. Moreover, since they are basically push type cylinders, they can be used in many mechanisms to furnish a short, sturdy push stroke. They are available in either end or side mounting, and a variety of bore diameters and stroke lengths.

Look over your shop and note the many places where Schrader ClampAirs will help you do jobs faster and safer—without fatigue...or, submit your problem to us. We will be glad to help you determine what will best fit your needs. Send us a letter outlining your particular installation, your idea, or fill out the coupon below.

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Please send me further information on the Schrader ClampAir and valves.

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At "Greenfield," nothing is left to chance, nothing is taken for granted. Attention is given to every detail — to insure a product as near perfect as modern engineering skill can make it.

Take tap chamfering. At "Greenfield," skilled operators working at specially designed automatic chamfering machines turn out taps which exceed all previous standards of perfection. Correct angle, concentricity, and length of chamfer in a tap insure a good tapping job for you. "Greenfield" taps, precision perfect, are your greatest guarantee of good tapping *every time.*

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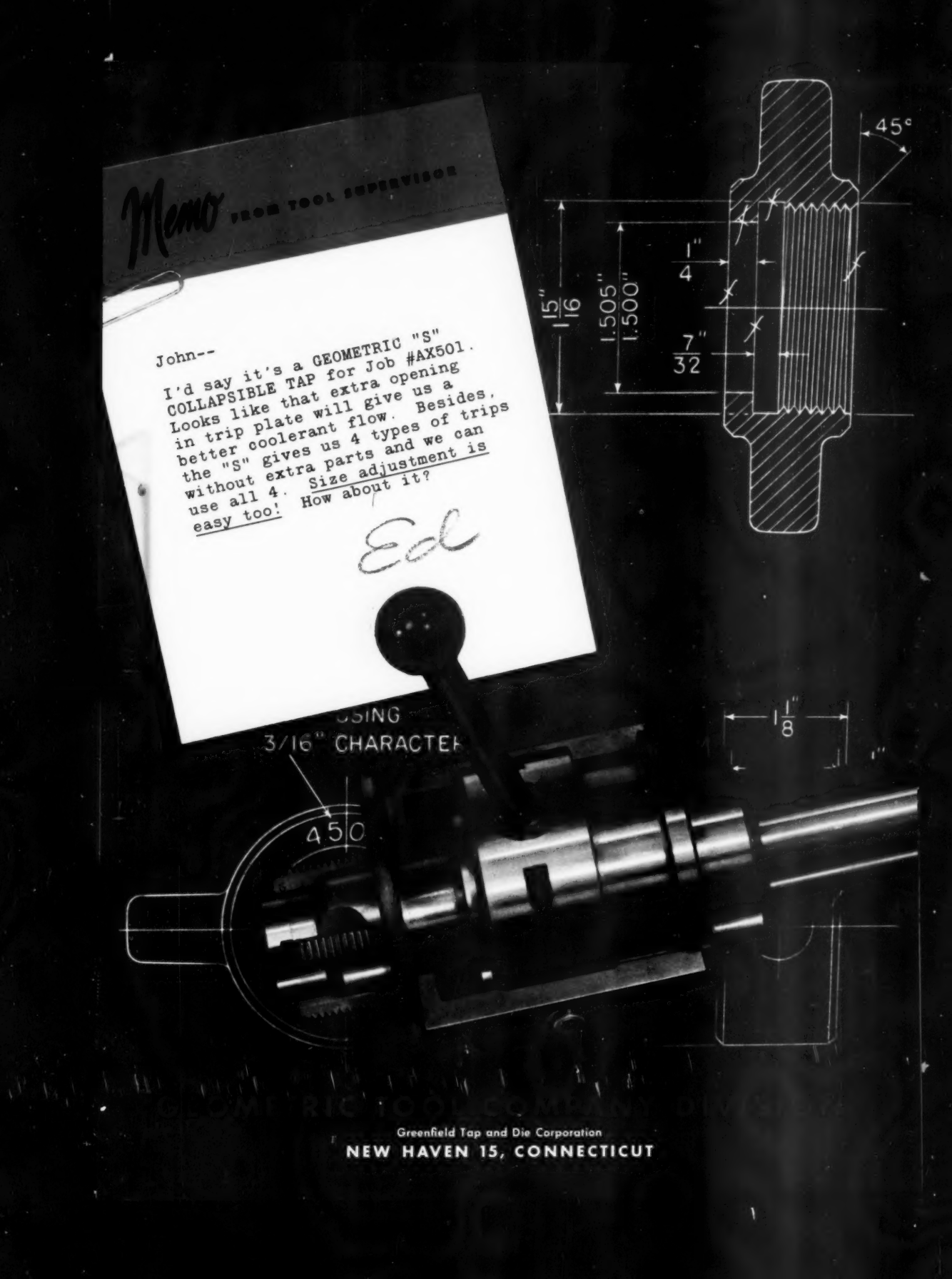
Memo FROM TOOL SUPERVISOR
John--
I'd say it's a GEOMETRIC "S" COLLAPSIBLE TAP for Job #AX501. Looks like that extra opening in trip plate will give us a better coolerant flow. Besides, the "S" gives us 4 types of trips without extra parts and we can use all 4. Size adjustment is easy too! How about it?
Ed
45°
15/16"
1.505"
1.500"
1/4"
7/32"
1 1/8"
3/16" CHARACTER
450

Greenfield Tap and Die Corporation

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Style "S"

SURE-GRIP Master Collets and Pads

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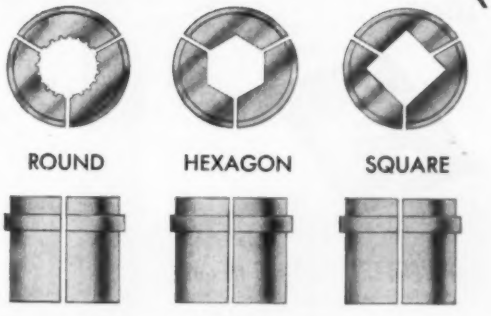

Ask for Style "S" and Style "B" Bulletins which give all performance features, price savings, and ordering information.

HARDINGE
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Just 1/2 the time...

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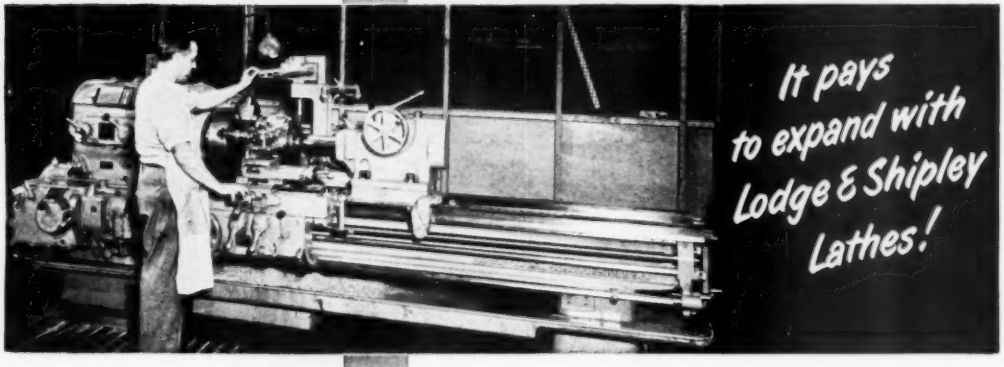
TWO MEN...

TWO LATHES...

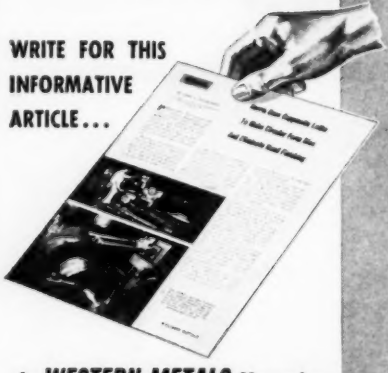
NOW...

ONE MAN...

ONE LODGE & SHIPLEY COPYMATIC



WRITE FOR THIS INFORMATIVE ARTICLE...



in ***WESTERN METALS*** Magazine
Written by
JOHN C. BUCHANAN
V.-P. in Charge of Mfg.
Norris Stamping & Mfg. Co.
Los Angeles, Calif.

...a reprint of Mr. Buchanan's full length article describing in detail methods and savings obtained with the COPYMATIC on this job is available on request.

Featured in an article in Western Metals magazine, here's another highly successful COPYMATIC installation: Saves 50% on production time . . . "one man handles all the jobs on the COPYMATIC," saving not only manpower but also time and tied-up machinery. "In addition, we realized greater accuracy," says John C. Buchanan, Vice President of Norris Stamping and Manufacturing Company, Los Angeles, California, in this article.

The Copymatic Lathe is used by Norris to machine and redress high-chrome, high carbon auto rim rolls with the unbelievable hardness of 62 to 65 Rockwell C.

The Lodge & Shipley COPYMATIC proves itself to be as productive on automatic duplicating as it is versatile on engine lathe work. Changeover from one to the other is instantaneous. There are no attachments or gadgets to put on or remove. Flat or round templates may be used for fast automatic production of any number of parts.

The double advantages of the COPYMATIC . . . ease and speed of hydraulic duplication plus Model X engine lathe versatility . . . make it a profitable producer for any size shop. Our engineers will show you what it can do in your shop. Write for detailed literature now.

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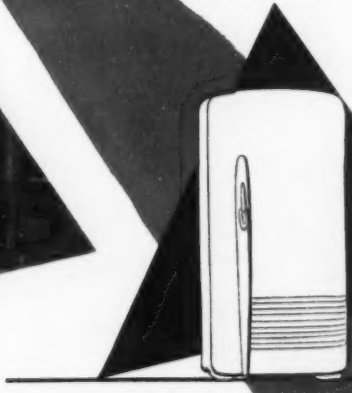
Cold Facts
about cutting costs



In the highly competitive field of domestic refrigerators, it is especially necessary that costs be controlled and kept to a minimum. That's why the Seeger Refrigerator Company at St. Paul, Minnesota, installed this 400 ton Clearing press to turn out their refrigerator door panels. They knew they would get uniform panels, and also obtain effective, steady press operation with the smallest amount of down time for die or press maintenance.

Warm up to these cold facts for cutting costs—they'll give you accuracy of product, maximum press production, and minimum operating costs. We'll gladly give you the necessary information for applying Clearing to your own situation.

CLEARING MACHINE CORPORATION

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CLEARING PRESSES

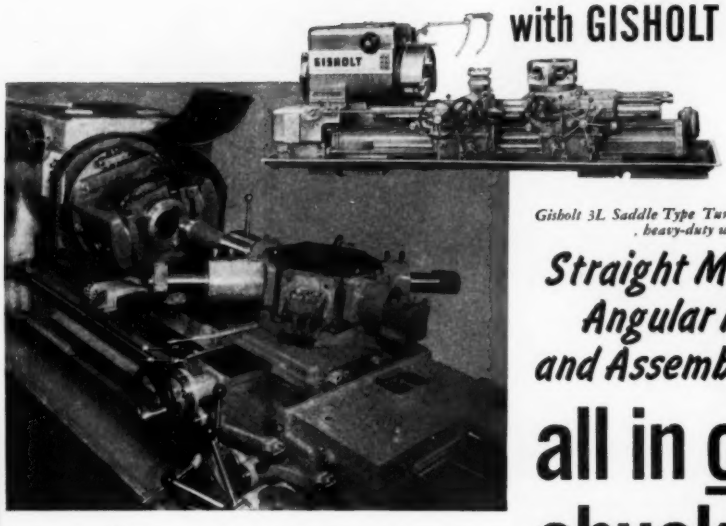
THE WAY TO EFFICIENT MASS PRODUCTION

CMC CLEARING

Nice work if you can do it...

and you can...

with GISHOLT Turret Lathes...



Gisholt 3L Saddle Type Turret Lathe—one of five sizes for heavy-duty work of all kinds

Straight Machining... Angular Machining and Assembly...

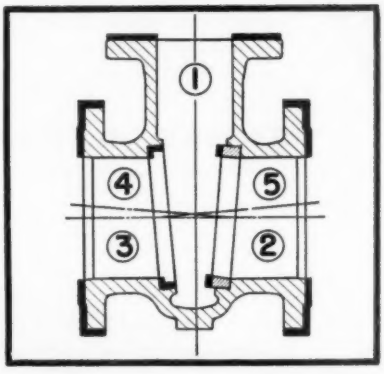
all in one chucking!

Talk about time-cutting ideas, here's the versatility of a Gisholt 3L Saddle Type Turret Lathe paying off again.

All operations required to machine these gate valve bodies are done in a single chucking with a five-position indexing fixture. In addition to machining the bonnet and the two ends, the recesses for the two seat rings are bored and threaded at a five degree angle.

Then the seat rings are inserted—and tightly screwed in place with a driver mounted on the turret. The driving is done with a constant torque—adjustable to suit each job. The final operation is finish facing the seat ring after it is in place with the cross-feeding turret.

Gisholt Engineers have storehouses of ideas to help you increase your production. Ask one to call.



GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Elmes METAL-WORKING PRESSES

now equipped with LOW-MAINTENANCE

pipeless hydraulic circuit

● This revolutionary Elmes hydraulic press design puts an end to high pressure piping troubles! On these new Elmes Presses, the main hydraulic circuit has *no piping*. All high pressure fluid is conducted through short, direct passages *drilled in the structural parts*. The only pipes in the entire press are the pilot, suction, and drain lines, and only the pilot line carries high pressure oil. *Maintenance and downtime are practically eliminated.*

Elmes Metal-Working Presses, with all the outstanding economies provided by pipeless construction, plus the matchless operating advantages of hydraulic power, are available to you at *no premium!* Find out how *your* production will benefit from the superior performance of Elmes Pipeless Hydraulic Presses. For complete details on this revolutionary Elmes development, write *now* for your copy of new Bulletin 1011.

The extensive high pressure piping in this conventional hydraulic circuit, with its long, indirect fluid passages, makes for frequent downtime and high maintenance costs. This time and cost burden is practically eliminated by the new Elmes pipeless construction.

ELMES DRAWING AND FORMING PRESS equipped with new Pipeless Hydraulic Circuit. Cut-away front view section shows area around cylinder barrel. Note in both front and rear views the absence of piping in the main hydraulic circuit. Any Elmes Metal-Working Press, standard or special, can be supplied with pipeless construction. Flexibility of design permits the use of several sizes of pumps to perform various press functions.

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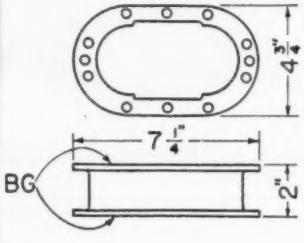
BLANCHARD *is BEST...*

for roughing and finishing parts such as these



Pump bodies are typical of a wide variety of jobs requiring one operation to remove stock from the rough casting, then a finishing operation for extreme flatness and close size tolerances.

For heavy roughing, use the Blanchard No. 18. On this job, 22 pump bodies are rough ground in one chuck load. .100″ is removed per side.

For accurate finishing, use the Blanchard No. 18. 16 pump bodies are finished in one chuck load to a tolerance of ±.0003″ and flat to .0003″ to assure a tight joint.

For fast heavy roughing or accurate finishing, use the Blanchard No. 18. These parts are produced at the rate of 38 pieces (76 surfaces) per hour.

Send for your free copies of "Work Done on the Blanchard," third edition, and "Art of Blanchard Surface Grinding."

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

GUARANTEE OF QUALITY

IN SCREW MACHINE CUTTING TOOLS

The "P&W" trademark on all PRATT & WHITNEY Screw Machine Cutting Tools guarantees cleaner cutting action, trouble-free performance, reduced work spoilage, and extended tool life.

P&W

It constitutes a pledge of DEPENDABILITY, backed by more than 90 years of experience in the design and manufacture of QUALITY CUTTING TOOLS.

P&W Screw Machine Tools can be obtained from stock at your nearby P&W Branch Office listed below.

PRATT & WHITNEY DUOCONE DIES AND HOLDERS
PRATT & WHITNEY MODIFIED SPIRAL POINT BOTTOMING TAP
PRATT & WHITNEY STRAIGHT SHANK BLUE HELIX REAMERS AND STUB SCREW MACHINE REAMERS WITH FULL FLOATING HOLDERS
PRATT & WHITNEY T-CUT BLADES AND JOHNSON'S CUTTING-OFF TOOLS
PRATT & WHITNEY SCREW SLOTTING CUTTERS
PRATT & WHITNEY SCREW MACHINE KNURLING TOOLS

"THERE'S NO BETTER-PAYING INVESTMENT THAN THE RIGHT TOOLS FOR THE JOB"

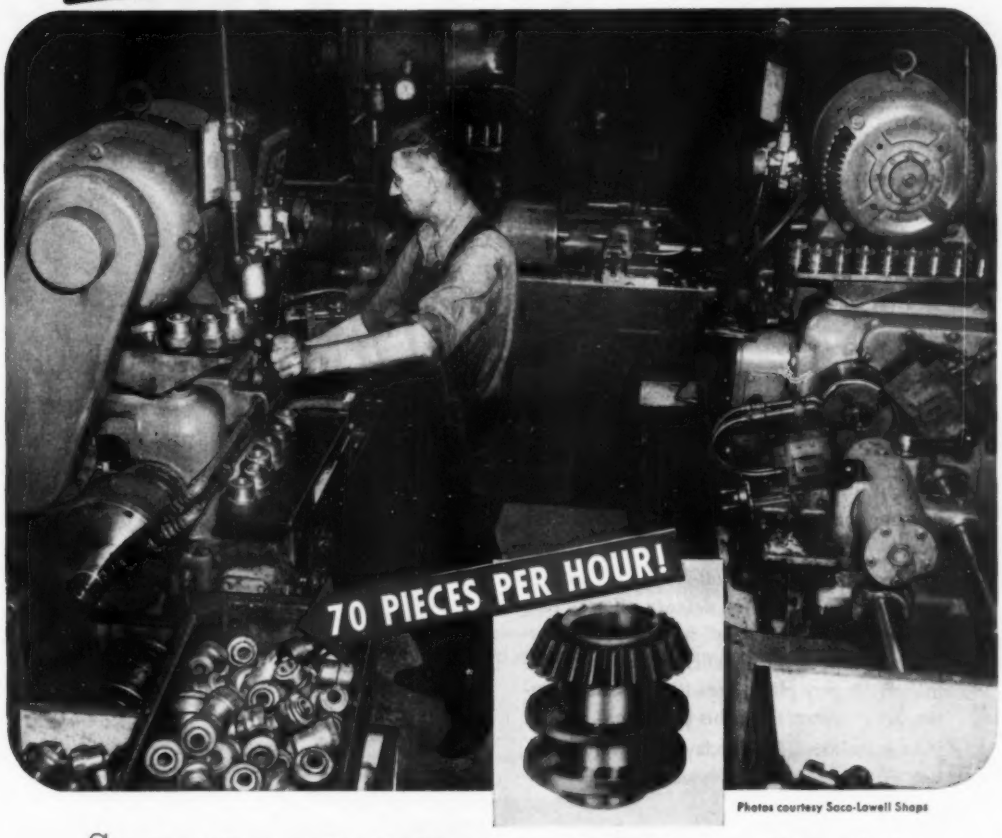
PRATT & WHITNEY

Division Niles-Bement-Pond Company
WEST HARTFORD 1, CONNECTICUT

Branch Offices: Birmingham • Boston • Chicago • Cincinnati • Cleveland • Dallas (The Lucas Co.) • Detroit • Houston (The Stacey Co.) • Los Angeles • New York • Philadelphia • Pittsburgh • Rochester • St. Louis • San Francisco • and from factory stock at West Hartford, Conn. • Export Department: West Hartford, Conn.

SENSITIVE RADIALS
FOSDICK DRILLING MACHINES
3′—4′—5′ RADIALS
ARE GETTING MORE ACCEPTANCE
HYDRAULIC RADIALS
WITH PRODUCTION MEN...TODAY
AUTOMATIC POSITIONING JIG BORERS
THAN AT ANY OTHER TIME
4BM-5BM SENSITIVE DRILLS
IN OUR 75 YEAR HISTORY!
UPRIGHT DRILLS
FOSDICK MACHINE TOOL CO.
CINCINNATI 23, OHIO
Send for Illustrated Folder of our Complete Line

FACTS on improving production!



Photos courtesy Saco-Lowell Shops

Saco-Lowell Shops, prominent builders of up-to-the-minute textile machinery, solved a production problem by using Jones & Lamson Fay Automatic Lathes to machine bobbin gear blanks. These meehanite castings are completely turned, formed and bored at the rate of 70 pieces per hour on three 8" Fay Automatic Lathes.

THESE LATHES ENABLE A SINGLE OPERATOR TO MEET THE REQUIRED PRODUCTION RATES.

Now, more than ever, the most efficient machines and methods are needed to make the most of your available manpower and material. Jones & Lamson is ready, willing and able to help you get maximum results from your turning, threading and inspection operations. Write *today* to Department 710.

Turret Lathes—Fay Automatic Lathes—Thread Grinders—Optical Comparators—Threading Dies

JONES & LAMSON
MACHINE COMPANY
Springfield, Vermont, U.S.A.

Machine Tool Craftsmen Since 1835

Facing the FACTS

WITH

BULLARD

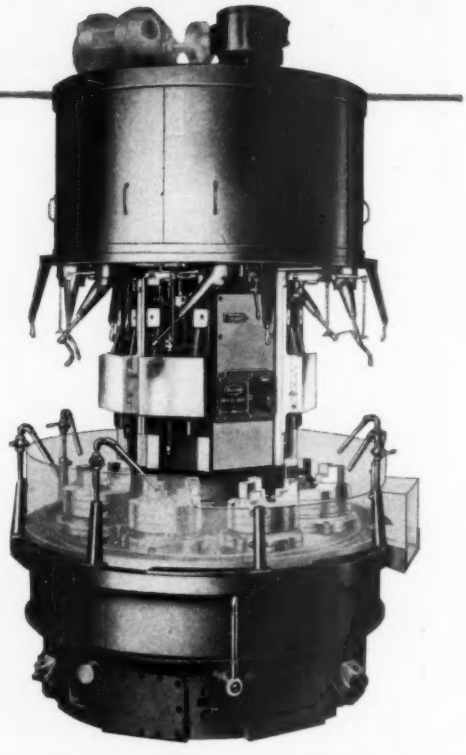
MULT-AU-MATICS

The Rearmament Program is not a pleasant thought BUT today it is a well advanced FACT in many manufacturing plants throughout the world.

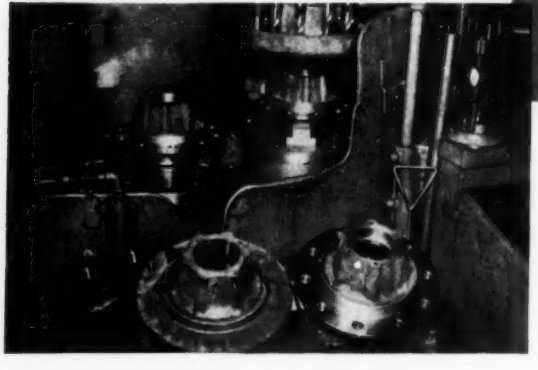
Once again Bullard Mult-Au-Matics are Key manufacturing units for defense efforts. Past experience in "tooling up" for such work provides a reliable and practical source of information for any plant already engaged or anticipating contracts on this program.

Mult-Au-Matics are today effectively handling many rearmament projects.

Let us analyze and assist in your manufacturing problems.



Type "D" Mult-Au-Matic 8 Spindle. Road Wheel Hub for General Patton Tank Face, Turn, Bore, Chamfer — Drill 6 holes in Hub and 10 holes in Flange



Mult-Au-Matics
Type "D" 8"-12" and 16" capacities
with 6 or 8 spindles.

THE
BULLARD
COMPANY
BRIDGEPORT 2,
CONNECTICUT

MODERN PRECISION TOOLS

MODERN COLLAPSIBLE TAPS

Modern Self-Opening Die Heads are available in both stationary and rotary types. The stationary type is made in a range of sizes with capacity for cutting straight threads from ⅛" to 7", and ⅛" to 6" for pipe threads. Rotary type, straight threads from ⅛" to 1¼", pipe threads from ⅛" to ¾".

MODERN SELF-OPENING DIE HEADS

Of unusually simple design with a minimum number of parts and no complicated mechanisms, this new Modern Collapsible Tap Style A-A helps meet industry's demand for faster, lower cost production. It is made in a wide range of sizes with adequate capacities for cutting straight threads and straight and taper pipe threads. All parts are of properly hardened steel, ground and precision fitted.

MODERN-MAGIC CHUCKS AND COLLET EQUIPMENT

Modern-Magic Quick Change Chuck and Collet Equipment virtually eliminates costly idle time usually present in revolving spindle operations. Tools are changed without stopping or even slowing the spindles. Modern-Magic Chucks are made in 6 sizes and two types: friction drive and positive drive. Modern-Magic Collets are available in a broad range of both standard and special types.

Modern Self-Opening Stud Setters are positive and entirely automatic in action, and can be operated in any position with either air or electrically driven portable tools. Also equally effective in drill presses where it is possible to drill and tap the holes and set the studs in successive operations. Made in two sizes ½" and ⅞" capacity.

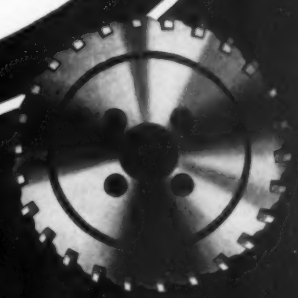
Modern Medium Duty Face Milling Cutters are of blade backed design, and are made in axial and radial types. Standard Modern axial type cutters are available in diameters from 4" to 24". Standard radial type cutters from 8" to 24" diameters. All blades, wedges and screws are interchangeable in all Modern Cutters regardless of diameters.

Detailed information covering any Modern Precision Tool in which you are interested will be furnished promptly upon request. Let us show you how Modern Precision Tools can help to speed up your production and reduce your costs.

Modern Precision Tools Include . . . . .

- STATIONARY SELF-OPENING DIE HEADS
- ROTARY SELF-OPENING DIE HEADS
- STATIONARY COLLAPSIBLE TAPS
- ROTARY COLLAPSIBLE TAPS
- MODERN-MAGIC CHUCKS AND COLLETS
- SELF-OPENING STUD SETTERS
- INSERTED BLADE FACE MILLING CUTTERS
- SOLID ADJUSTABLE DIE HEADS
- ADJUSTABLE HOLLOW MILLING TOOLS
- UNIVERSAL CHASER GRINDING FIXTURES

MODERN SELF-OPENING STUD SETTERS



MODERN FACE MILLING CUTTERS

Modern Precision Tools are produced by the originators of the Modern-Magic Quick Change Chuck and Collet Equipment.

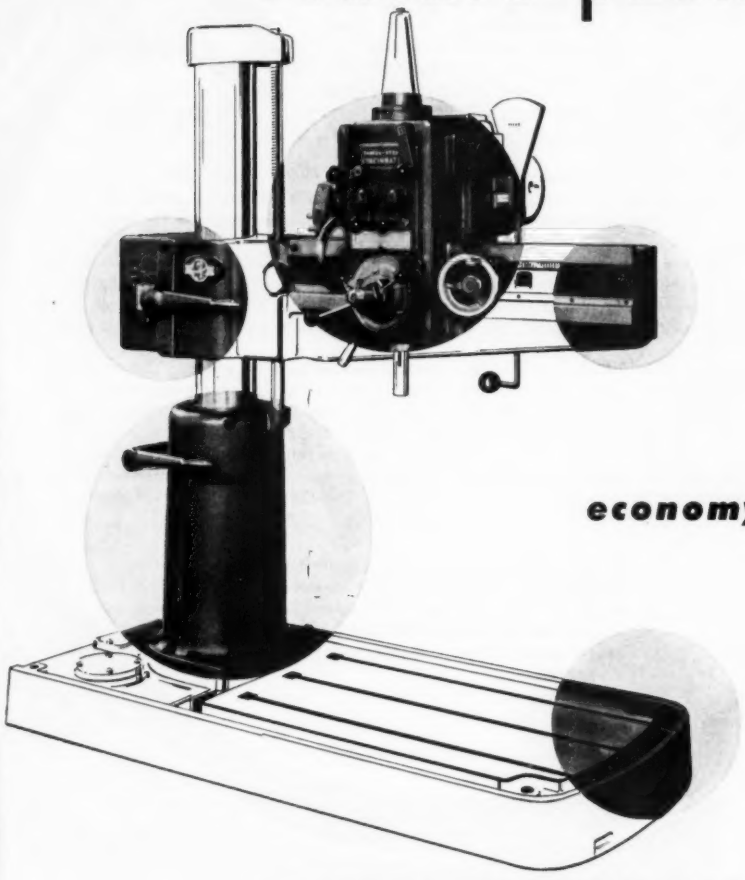
MODERN TOOL WORKS

DIVISION OF

CONSOLIDATED MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

feature-packed



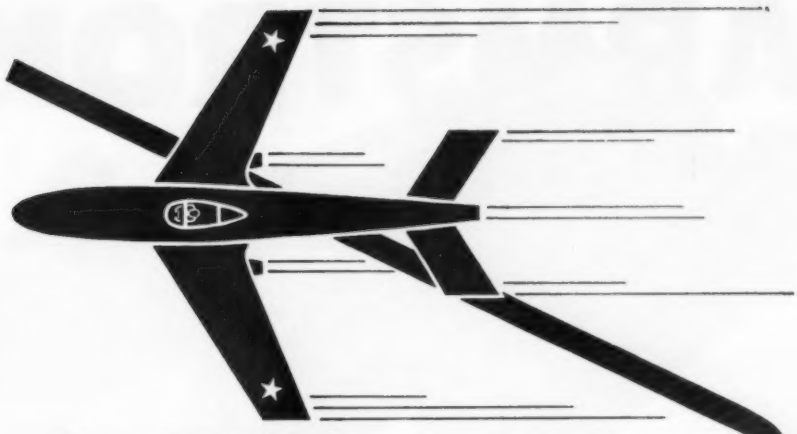
economy priced

The new Canedy-Otto **CINCINNATI ROYAL RADIAL** (3-foot arm, 7-inch column) has the features you need to handle up to 90% of your drilling requirements. It combines low cost with such high-priced radial features as: all-geared head, automatically pressure lubricated, 9 spindle speeds (30 to 1 overall ratio), 6 power feeds, flame hardened transmission gears . . . all shafts mounted on anti-friction bearings . . . ground tubular steel column mounted on two Timken tapered bearings . . . simple, trouble-proof column and arm clamps . . . hardened and ground head rail on arm . . . extra heavy base. Catalog CO-15 on request.

CANEDY-OTTO DIVISION

CINCINNATI 9, OHIO, U.S.A.

cincinnati lathe & tool co.



TUF-STUF'S best proving ground is in the air!

It pays to specify TUF-STUF aluminum bronze alloys for parts that must stand up

● Because they are both light and tough, TUF-STUF aluminum bronze alloys have proven invaluable in America's aircraft as valve-seat inserts, spark plug inserts, valve guides, gears and other vital parts.

If your product requires machined parts that are strong but light, resistant to corrosion, long wearing and resistant to oxidation even at high temperatures, then TUF-STUF is the right alloy for the job.

TUF-STUF alloys are furnished in the form of forgings, rods and screw machine parts. They fill Federal Specification QQ-B-666, Grade B, and several other variations. Because of the increased use and demand for both aluminum and copper, jobs carrying a Defense Order Number are receiving first consideration.

MUELLER BRASS CO.

PORT HURON 18, MICHIGAN

ARMSTRONG

ARMSTRONG TOOL HOLDERS

are more efficient

It takes years of development, improvement and practical experience to create and perfect a line of tools. This has been the specialized work of ARMSTRONG, a contribution to machining efficiency which they have carried on continuously for 59 years.

Starting with the Armstrong Principle of inserted cutters in permanent tool shanks that "Saves: all Forging, 70% Grinding and 90% High Speed Steel," they created this unique method of tooling which has changed shop practice in over 96% of the machine shops and tool rooms. And, today, in a specially built plant, equipped with every modern facility and staffed with experts in each phase of tool making, this work goes on.

To you, as a tool user, here is always one safe principle — specify ARMSTRONG TOOL HOLDERS for every operation on lathes, planers, slotters and shapers, for turret lathes and screw machines. They are cataloged and stocked by all leading supply houses.

Write for Catalog

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5215 W. ARMSTRONG AVE. CHICAGO 30, U.S.A.

Eastern Whse. & Sales Office: 199 Lafayette St., New York 12, N. Y.

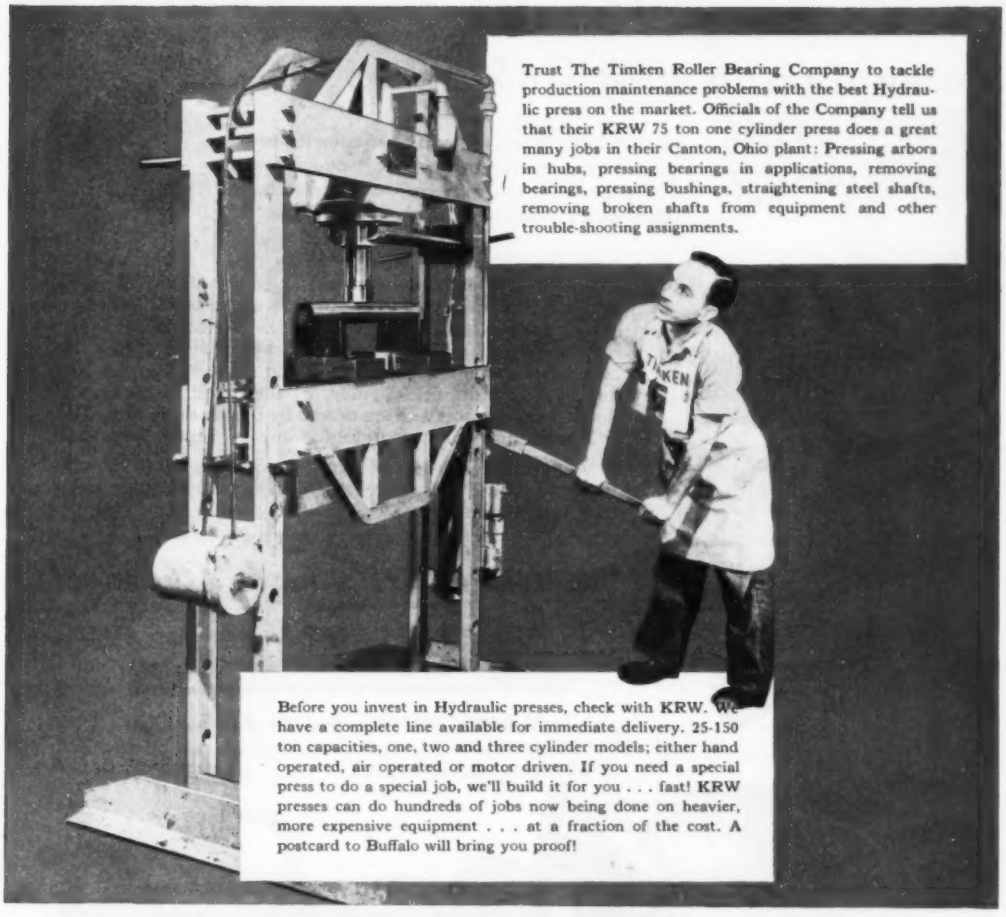
Pacific Coast Whse. & Sales Office: 1275 Mission St., San Francisco 3, California

TIMKEN

REG. U. S. PAT. OFF.
THE TIMKEN ROLLER BEARING COMPANY
TAPERED ROLLER BEARINGS

Bears Down on Pressing Problems

WITH K.R. WILSON HYDRAULIC PRESS



Trust The Timken Roller Bearing Company to tackle production maintenance problems with the best Hydraulic press on the market. Officials of the Company tell us that their KRW 75 ton one cylinder press does a great many jobs in their Canton, Ohio plant: Pressing arbors in hubs, pressing bearings in applications, removing bearings, pressing bushings, straightening steel shafts, removing broken shafts from equipment and other trouble-shooting assignments.

Before you invest in Hydraulic presses, check with KRW. We have a complete line available for immediate delivery. 25-150 ton capacities, one, two and three cylinder models; either hand operated, air operated or motor driven. If you need a special press to do a special job, we'll build it for you . . . fast! KRW presses can do hundreds of jobs now being done on heavier, more expensive equipment . . . at a fraction of the cost. A postcard to Buffalo will bring you proof!

K·R·WILSON

215 MAIN ST.
BUFFALO 3, N. Y.

Ask your Machinery dealer to quote you or write or wire Dep't 11

Cut...

LARGE HOLES

. . . thru any machineable material up to 1⅛ *INCHES* thick!

Here is a premium tool which makes it possible to saw holes in one short operation . . . large holes which heretofore had to be laboriously machined "a-chip-at-a-time."

MARVEL High-Speed-Edge Hole Saws have strength to withstand the terrific peripheral strains of heavy duty operation in lathes, drill presses or portable power tools. They have a high speed steel cutting edge which is electrically welded to a tough, alloy steel body, high speed steel pilot drills, heavy hexagonal shanked arbors and sufficient set for deep drilling. They are self-aligning, as the larger diameter saws float on their arbors and are driven by double drive pins. They will saw round holes accurately in any machineable material.

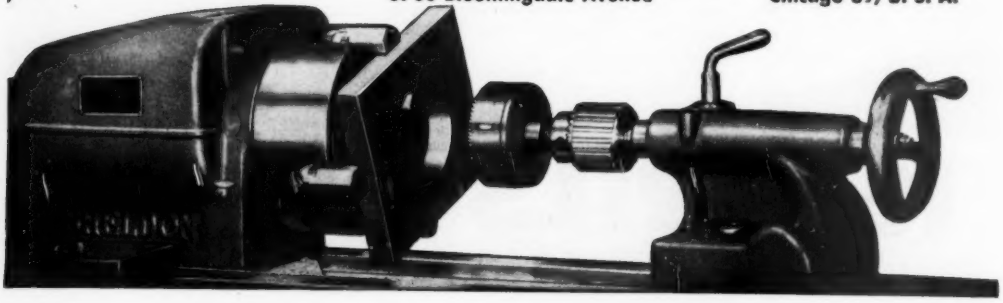
MARVEL High Speed-Edge Hole Saws come in 35 sizes, from ⅝" to 4½". They are carried in stock by leading industrial distributors.

WRITE FOR BULLETIN ST-49

"MARVEL" *has Always had the edge!*

MARVEL *Metal Cutting* **SAWS**
Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO.
"The Hack Saw People"
5700 Bloomingdale Avenue **Chicago 39, U. S. A.**



BRIDGE THAT "EXPERIMENTAL" GAP

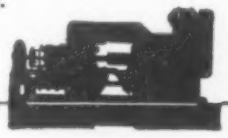
We've done your preliminary planning for you.

All the educational orders, the trial setups, the essential steps for automatic production of parts for quick rearmament were thought out—and *proved* out—months ago by National Acme tool engineers.

Today, Acme-Gridley Automatics, by the hundreds, already are meeting the tolerances and time limits, turning out untold millions of these armament parts.

This ready-made experience—standardized tooling, standardized production methods and engineering techniques—plus the latest developments for top performance on your Acme-Gridleys—these are your safest guide to quick action and *profit*.

Bridge that experimental gap—start with National Acme's ready-made reliable experience. Just tell our engineers what you need.



THE NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

No other source offers a line so COMPLETE—so much design and tooling EXPERIENCE in Multiple and Single Spindle Bar and Chucking Automatics.

For Busy Readers...

AMERICAN MACHINIST IS PLANNED for the production man who is always in a hurry, literally arranged so that "he who *runs* may read". While the entire magazine is streamlined to save your time, the editors assemble in each issue a balanced diet of data set up for maximum convenience to suit your schedule

FOR ECONOMIC INTERPRETATION IN FIVE MINUTES, READ:

SPOT NEWS—Pertinent paragraphs on new developments
WASHINGTON—The digest of Government for Metalworking
DETROIT—What the bellwether automotive plants are doing
NEW TOOLING—Who's buying what new equipment, and why
GAGING METALWORKING—Current economic and business trends
EDITORIAL—Our point of view on current problems

FOR CAPSULIZED TECHNICAL DATA IN TEN MINUTES, READ:

BACKLASH—Excerpts from current letters to the editors
TALKING SHOP—Ideas from talks with shop men
NEWS OF METALWORKING—Interpreting day-to-day developments
NEW EQUIPMENT, MATERIALS, PARTS—Compact, but complete descriptions. Check ads, too, for new units, new uses, new ideas.

IF YOUR JOB INVOLVES TOOLING, DON'T MISS:

PRACTICAL IDEAS—Notable solutions to knotty problems
TALENTED TOOLING—How tool engineers tailored machine to job
SHORT CUTS—Kinks to ease shop headaches
REFERENCE BOOK SHEETS—Keepable data in usable form
SHOP SHOTS—Ideas in pictures from the field
ADVERTISING—Many ads show new, or special tooling

IF THE STRESS IS ON PERSONNEL, CHECK:

TIPS TO TOP SHOP MEN—Numbered nuggets on handling people
ROUND TABLE—Two points of view on a tough question
ROUND TABLE DISCUSSIONS—Reader opinions of shop problems

TO ORGANIZE YOUR LONGER READING, READ:

CONTENTS PAGE—Classified by subjects of your major interest
CHIPS & QUIPS—*Why* and *how* the articles were chosen, *what* they tell
ADVERTISING INDEXES—Ads are indexed both by product and by maker, for your quick reference either way

ARTICLES IN AMERICAN MACHINIST *are presented in shortest possible compass, as text, pictures, or a combination, depending on subject and available material. This makes your longer reading* shorter per idea, *thus more efficient and more effective. We spend our time to save yours.*

EASIEST *OF ALL SHEARS* TO OPERATE

"EASIEST of all Shears to operate" are not just our words. They are words of operators being heard with increasing frequency as more Steelweld Shears are placed in plants throughout the country.

Men who have worked for many years on shears of various makes and know them through and through are acclaiming the many features incorporated into Steelwelds — features that ease their work, speed production and make for greater accuracy and minimum maintenance.

Steelweld Shears are entirely new machines designed from scratch as such. They are not a variation of or an adaptation to any previously existing machine. The designers of these new shears were free to incorporate all ideas and features that would result in better machines. They were not hampered by tradition or previous designs or models.

As a result Steelweld Shears are radically different with advantages never before possible.

Whether or not you are in need of a shear at this time, if you work plate in any thickness up to 1¼-inch or length to 18 feet, we urge you to get more data on these modern machines. Keep informed — send for the catalog below.

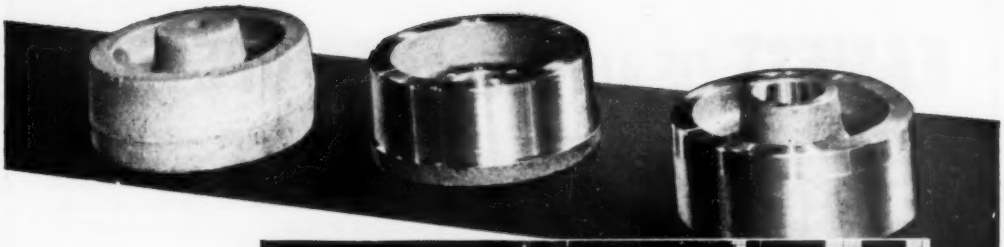
GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

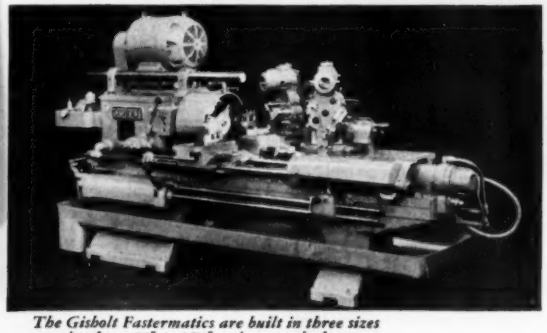
1405 EAST 282nd ST. *WICKLIFFE, OHIO*

STEELWELD PIVOTED BLADE SHEARS

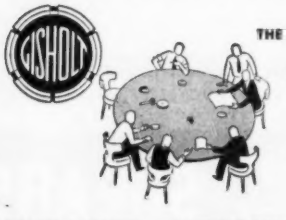


from
41.9 Minutes
down
to
15 Minutes

That's Productivity with the GISHOLT FASTERMATIC



The Gisholt Fastermatics are built in three sizes ranging from 21" to 36½" swing over bed.



THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

The cost of machining these gear blanks at the Falk Corp. took a sharp drop when the Fastermatics took over. Time was cut nearly two-thirds. Moreover, human errors were eliminated, thanks to Fastermatic's ability to hold close tolerances.

One operator tends 2 Fastermatics and a honing machine. Simple tooling makes it possible to handle 9 different sizes of gear blanks.

These modern automatic turret lathes enable you to handle a larger number of operations in one chucking—and cut costs to the bone on a wide variety of work. Ask for facts about them.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

WAX LUBRICANTS !

Can greatly improve lubrication on even the most difficult metal forming and cutting jobs...Try them!

DRAWING STAINLESS STEEL

Production runs on thousands of pieces of No. 405 stainless drawn to the shape shown at the left proved that wax as the lubricant permitted drawing the metal far beyond its theoretical capacity and eliminated tool wear to such an extent that it could not be measured by micrometer.

JOHNSON'S WAX LUBRICANTS

offer new metal working possibilities for ferrous and non-ferrous metals

Wax has proved its ability to do many metal lubricating jobs conventional lubricants cannot do.

Wax Lubricants have so improved lubrication during deep drawing, cold heading, tapping and cutting operations, especially on the difficult metals where oils become fugitive, that galling, tearing, die wear, welding of metal to tools, etc., were virtually eliminated. Wax Lubricants are clean, easily degreased and adaptable to any type of application. They will resist temperatures up to 550° F.

COLD HEADING STAINLESS STEEL

Wax, used as the lubricant on stainless steel wire before it entered the cold heading machine, permitted far better fill-in of shoulders during the upsetting operation. Tests on waxed stainless wire offer evidence that copper flashing for lubrication purposes is unnecessary.

JOHNSON'S WAX LUBRICANTS

- Permit multiple draws with one application
- Increase time interval between tool repair
- Increase die life
- Decrease rejected and damaged pieces
- Provide lubrication under extreme heat
- Protect parts and tools against corrosion

SHOE BENDING ALLOY TUBE

Wax used as the lubricant in the shoe bending of hard alloy tube reduced the required bending pressure by one-half, and eliminated the loss due to crimping and buckling.

Write for details concerning the use of Johnson's Wax Lubricants for your specific jobs. Give them a production test.

LUBRICATING SELF-TAPPING SCREWS

A special wax blend adopted by screw manufacturers for lubricating self-tapping screws provided as much as 50% torque reduction with the improved lubrication.

S. C. JOHNSON & SON, INC.

Industrial Products Department AM4, Racine, Wisconsin

SCIAKY WELDERS MEET THE SPEC'S . . .

For Aircraft and Other Non-Ferrous Welding

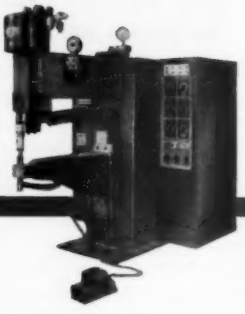
SCIAKY guarantees to qualify its new Series PMCO2ST Resistance Welder to MIL 6860 and 6858 (formerly known as ANW-30 and 32) Air Force-Navy Specifications at time of installation in your plant. The design and performance of this machine is based on Sciaky's past experience in building the majority of all welders used for welding to the ANW specifications.

The PMCO2ST Welder offers certain advantages over previous machines, particularly its ability to handle, by simple adjustment, *all* of the following materials:

Aluminum	**Monel**	**Nimonic**
Magnesium	**Inconel**	**Titanium Alloys**
Brass	**Stainless**	**Crown Max**
Mild Steel	**Super Stainless**	**Other Alloys**

For complete data, write for NEW BULLETIN.

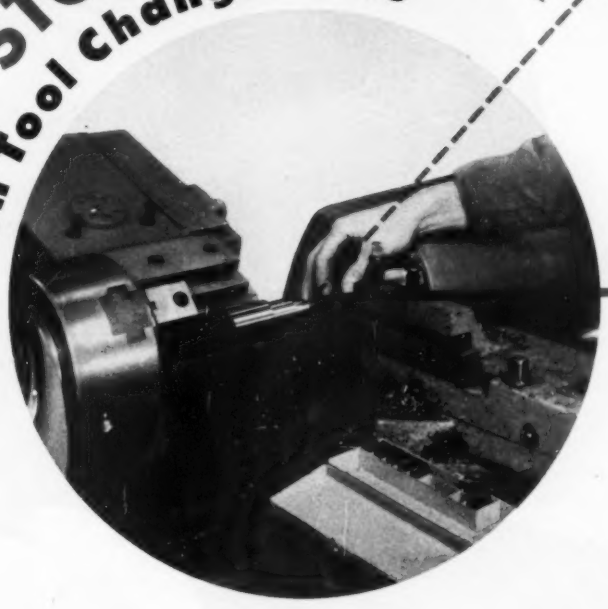
SCIAKY BROS., INC.
4919 W. 67th St., Chicago 38, Ill.



Brief Data

100 KVA at 50% duty cycle. 220 and 440 volt 3-phase 60 cycle standard. Available with special controls for 25 and 50 cycle current. Standard throat depths 36", 48" and 54". Welding range to MIL specifications (two thicknesses): aluminum and magnesium alloys .025" to .081". SEND FOR NEW BULLETIN.

How to STOP the CLOCK on Tool Change Time



You can change Indexible Insert Tools on the Monarch Mona-Matic in *Just 8 Seconds Flat!*

MONARCH INSERT TOOL KIT, with tool holder and 9 inserts, each with 3 cutting edges on each end. These 54 cutting edges can be identically reground by merely squaring end and grinding chip breaker if desired. Cuts tool costs and tool change time to a fraction.

THE FAMOUS MONARCH MONA-MATIC—the ultimate for production turning operations. Let us prove with actual job performance reports, how it outperforms ordinary multiple tool machining methods.

Contrast this procedure with the conventional solid tool change! Don't touch the tool holder adjustment. Take a turn on the clamp screw—lift out the indexible insert, revolve it on its axis and replace it—tighten the same screw. *That's it!* You haven't changed your tool setting in any way. You don't need any trial cuts—any new miking of the job—any resetting of the tool. Just start removing metal where you left off.

Here's the simplest and quickest tool change found on *any* production turning equipment. Applying it to the Monarch Mona-Matic is almost like gilding the lily. Even with conventional solid tools, this high-output production lathe can show you truly amazing results in increased production, lower tool costs, shortened setup time and subsequent grinding time. We mean BIG results, which we will gladly substantiate with job data. And with insert tools, the Mona-Matic's even better!

Just one more minute! You're always reading ads that say "Write for details." This time, *do it* (requesting Booklet 1804)—and enjoy the inevitable result in your future operating statements . . . *The Monarch Machine Tool Co., Sidney, Ohio.*

FOR A GOOD TURN FASTER—TURN TO MONARCH

Monarch
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES

Life-Line motor

PAIRED FOR PRODUCTION

Life-Linestarter

ASSURE
production schedules with these two

Climbing production curves necessitate squeezing out every possible productive minute from every production machine. There's no time for motor and control "time out". Together or individually, Life-Line motors and starters offer the best assurance of continuous production. They are built to—

STOP outages due to improper bearing lubrication. Life-Line motors, with their prelubricated, sealed-for-life bearings, need no lubrication. Grease guns can be thrown away—motor lubrication schedules forgotten.

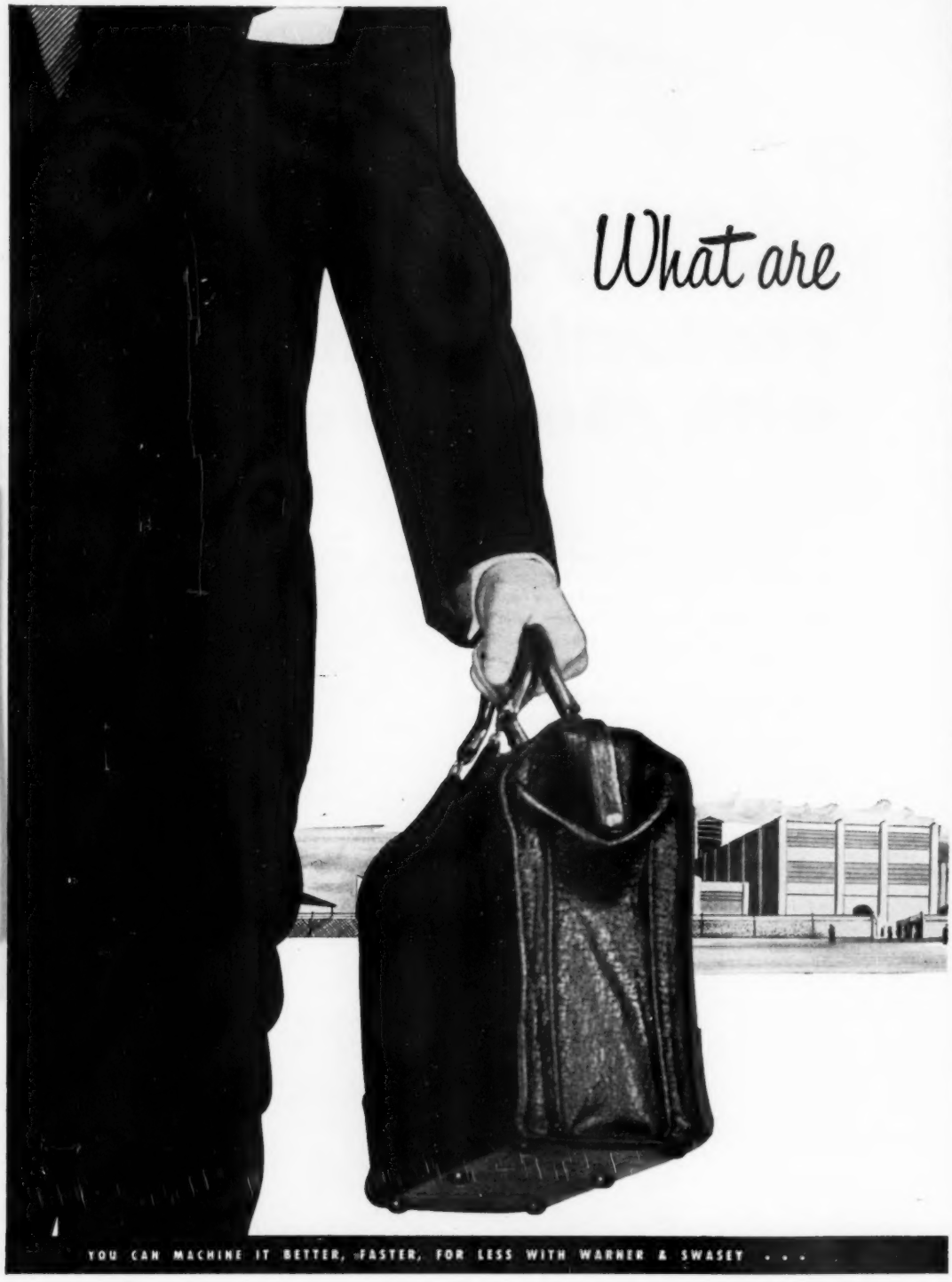
STOP outages due to cracked and broken motor frames. Life-Line motor frames stand up to the hard knocks of day-to-day use. They're steel. More protection is afforded with less size and weight. This rigid frame maintains bearing alignment and positive rotor air gap.

STOP outages due to burned and pitted starter contacts. Life-Linestarter's® exclusive "De-ion®" arc quencher quickly extinguishes destructive arcs. The "De-ion" grid snuffs out arcs . . . contacts last longer.

STOP outages due to inadequate overload protection. Life-Linestarter prevents motor burnout due to overloads. The bimetallic, snap-action, disc type of overload relay shoulders the burden. Precise calibration . . . not affected by aging or oxidation.

Other Life-Line features that will aid you in meeting increased production schedules are covered in "Life-Line Book", B-3842 and "Tomorrow's Starter Today", B-4677. Ask your Westinghouse representative for your copies. Or write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-21647

YOU CAN BE SURE... IF IT'S
Westinghouse
Life-Line
MOTORS and CONTROLS


What are
YOU CAN MACHINE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY . . .

your salesmen doing these days?

● This question is being asked of us pretty frequently.

Actually our "salesmen" are 45 factory-trained machine tool specialists . . . field engineers whose most important job today is to help you increase production for defense in every way they can. For instance:

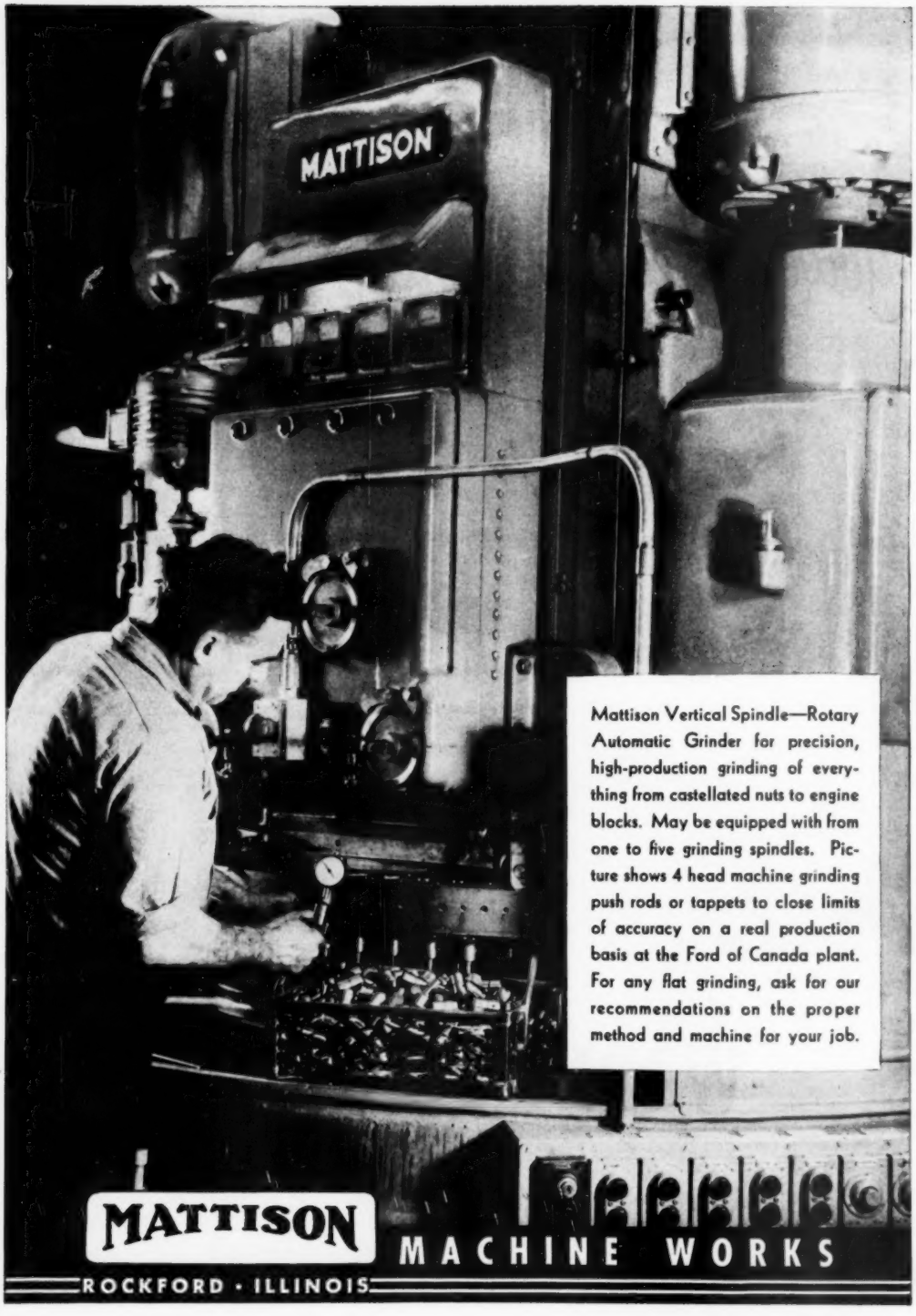
1. *To help you select the type and size turret lathe, automatic or tapping machine for your job.*
2. *To see that you have and use the right tools with your present machines.*
3. *To make sure that you buy no more machines or tooling than necessary.*
4. *To help you reconvert your present machines.*
5. *And, as always, to recommend the machine you need —even if it ISN'T a Warner & Swasey.*

Busy as he is, your Warner & Swasey Field Engineer will be glad to help you whenever he can. He's a good man to know these days. Get in touch with him when you have a machining problem.

WARNER & SWASEY

MACHINE TOOLS — CLEVELAND, OHIO

TURRET LATHES, MULTIPLE & SINGLE SPINDLE AUTOMATICS, AND TAPPING MACHINES

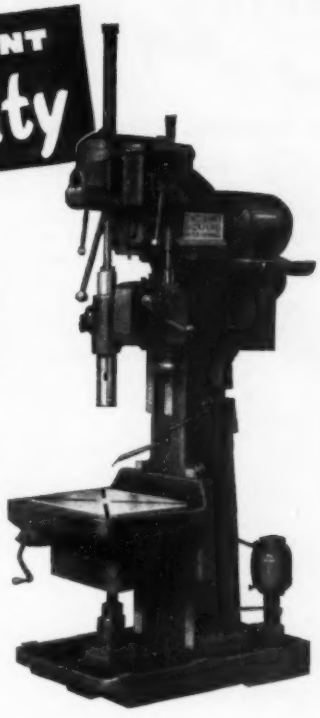


Mattison Vertical Spindle—Rotary Automatic Grinder for precision, high-production grinding of everything from castellated nuts to engine blocks. May be equipped with from one to five grinding spindles. Picture shows 4 head machine grinding push rods or tappets to close limits of accuracy on a real production basis at the Ford of Canada plant. For any flat grinding, ask for our recommendations on the proper method and machine for your job.

MATTISON MACHINE WORKS

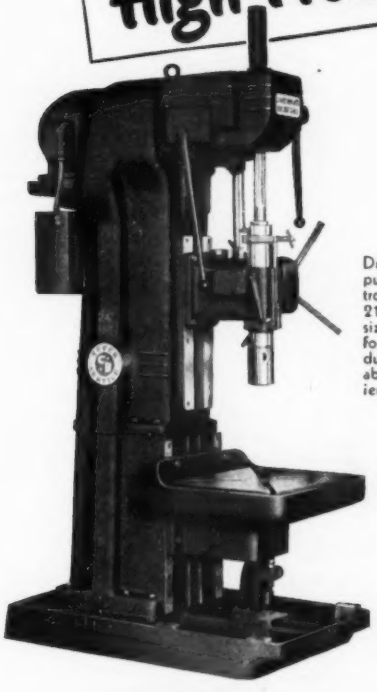
ROCKFORD · ILLINOIS

WHEN YOU WANT Versatility



All geared, sturdy, accurate and versatile, furnished in 21", 24", 28" sizes. Built in both box type and round type to suit the particular need.

WHEN YOU WANT High Production



Direct Drive, with push button control of motor—in 21", 24" or 28" sizes. Simplified for low cost production, yet adaptable and convenient.

Opportunity of selection means increased value to the buyer—the power to select exactly the machine suited to the particular job.

Cincinnati Super Service Upright Drills are built in production, and all geared types—one for high production, and on the other, versatility of performance.

Both types of these modern, up-to-date upright drills are sturdy, fast and rigid. They give long, trouble-free performance, and assure the user "low cost per hole."

Write for bulletin U-27 (Direct Drive Production Super Service Uprights) and bulletin U-25 (All Geared Super Service Uprights).

THE CINCINNATI BICKFORD TOOL CO.
RADIAL AND UPRIGHT DRILLING MACHINES
SUPER SERVICE
Radials 7½" dia. col., 2½" arm, to 96" dia. col., 12' arm.
General purpose Uprights, 21" to 28" sizes.
Production Uprights, 21" to 28".
Jig Borers, Portable Horizontals, Spacing Table Machines.

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

TRY THIS *cost-cutting team* **for CARBIDE GRINDING**

Wickman Steel-Bonded Diamond Wheels practically indestructible with extra long life. Diamond particles stay in place until completely worn. Finish tools better for longer tool life.

Wickman Resinoid-Bonded Diamond Wheels for faster and freer carbide cutting and less frequent wheel dressing.

Wickman Chip-Breaker Diamond Wheels steel-bonded for much longer life than other chip-breaker diamond wheels. Reduce wheel and tool costs materially and speed grinding 3-4 times.

Complete facts in free 52-page catalog.

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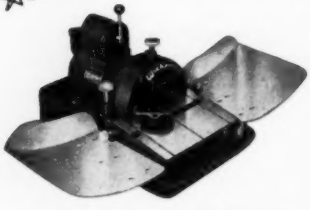
Grinding with Diamond or Abrasive Wheels is

☆FAST! ☆ECONOMICAL!



on the Wickman GF-2-A

With 1 HP reversible motor and impeller-type 12 gph coolant pump, this heavy bench grinder delivers fast, economical grinding with both silicon carbide abrasive wheels and Wickman steel-bonded diamond wheels. Wheel guards and splash protectors, three position table for wheel wear adjustment, plus a protractor slot for angular grinding, make this the ideal grinder for all off-hand grinding around the shop.

Delivery From Stock. Send for bulletin.

THE **Wickman** MANUFACTURING CO.
15533 Woodrow Wilson Ave.
DETROIT 3, MICHIGAN

Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Heat Treat for Dies

Can you advise me what method of pack carburizing is employed, and what heat treatment cycle is involved in making the punches and dies mentioned in "Die Life Test Cuts Cost of Laminations?" (AM, Nov. 27, 1950.)

J. Hastings
The Belmos Co., Ltd.

Pack in suitable activated carburizing compound. Preheat pack at 1700 F approx. Heat to 1950 F and hold until work has been ½ hr at temperature. Quench in salt at 1100 F, in oil, or in air. Temper at 1025 F. Avoid excessive amounts of austenite in the carburized case by double and triple tempering.

A. T. Hamill
Westinghouse Electric Co.

Numbers Information Needed

I would like to obtain complete data on part numbering systems for diversified products. If you can recommend publications of this type, it will be greatly appreciated.

Paul H. Schulte, *Project Engineer,*
Wheel Goods Division,
Reo Motors, Inc.
Lansing, Mich.

We suggest you consult Section 11 of the "Tool Engineer's Handbook," published by the McGraw-Hill Book Company, and Section 20 of the "Production Handbook" by Alford & Bangs, published by the Ronald Press Company, New York. These books explain the principles of coding and numbering, and as plants often develop their own system of numbering, this information may be enough to guide you in working out the system that will best suit your particular needs.—ED.

Misrepresentation?

I was slapped down on Page 113 (*AM*, Mar. 5—Thread Chasing by the comparison, "Chasing 1890" versus "Chasing 1950." This is a misrepresentation that even the Soviets wouldn't try. As you know, machine tools were not so pitiful in 1890. Many of them are still in operation.

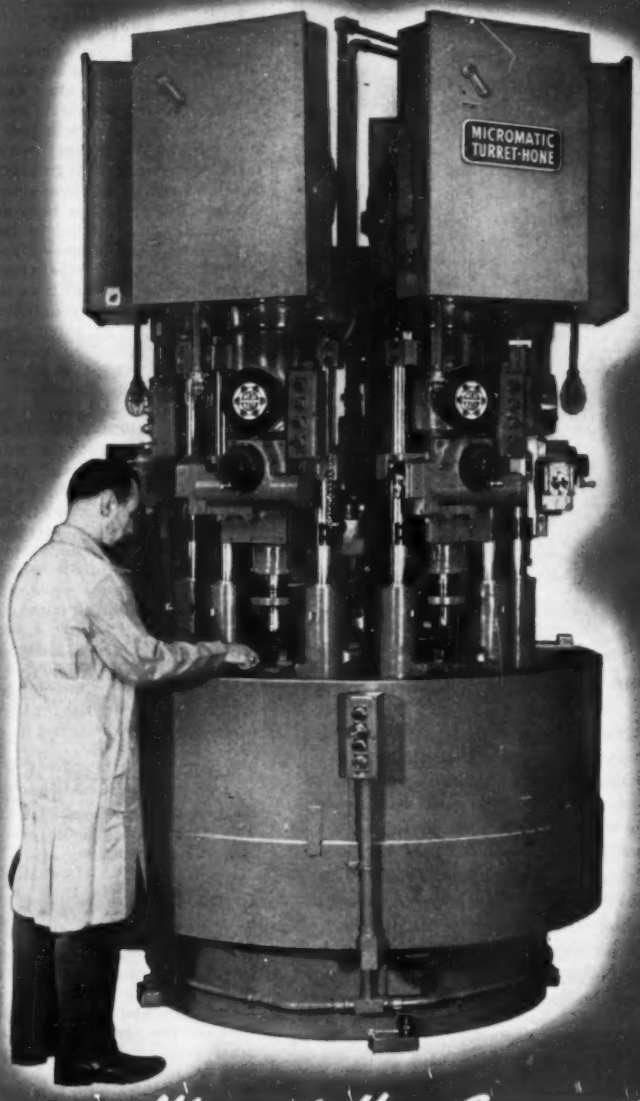
The "comb" tool that you show was probably used for turning threads on wood as the cover illustration seems to indicate. It could still be used for this purpose, so the artwork might be turned over to some magazine like "The Woodworking Hobbyist." It doesn't belong in your magazine.

The self-opening diehead was probably introduced between 1900 and 1910. Yet, before that, solid dieheads were in use for many years. So, the 1890 contrast to "Chasing 1950" would more properly be a hand screw machine with *solid* die on a turret and two belts on the spindle. The one belt would be open, the other crossed. A double shifter arm would move the belts simultaneously, and forward and reverse belts would alternately ride on a loose pulley. I am trying to explain that the spindle is reversed after the cutting of the thread to back the screw out of the die.

Max G. Gebauer
Armco Steel Corp.
Middletown, Ohio

The "comb" tool was—and is, even now—used for threading steel. Our authority for its common use in 1890 is Fred Colvin, our editor emeritus, who used it at that time. It was carved in wood for our cover, true; but that's artistic license. And it is used on wood—winepress screws, for example . . . As to the self-opening diehead, the picture shows one with carbide dies threading a ¾-in. steel bar at 2000 rpm. There may be faster chasing, but we haven't seen it—or even heard of it from Russia. Mr. Gebauer should have noticed the "arrested" look of the coolant—which indicates a stroboscopic picture—and the flow pattern around the bar, which is indicative of very high speed.—Ed.

NEW *High Production • High Precision* TURRET • HONE



SIX MICROHONING UNITS

One Machine
One Operator

THIS new model 736-6 TURRET-HONE finishes a part every five seconds. The operator unloads and loads the fixtures as they pass the control station. As the loaded fixture leaves the control station it automatically lifts into position, the tool starts rotating, reciprocating and expanding. The machine rotates continuously. When the part is "to size" the automatic MICRO-SIZE control stops the tool and drops the fixture. As the fixture passes the operator again, a new part is loaded and the cycle continues. This is repeated on each unit.

Micromatic Hone Corporation 8100 SCHOOLCRAFT AVENUE DETROIT 4, MICHIGAN

District Field Offices: 1323 So. Santa Fe., Los Angeles 21, California • 614 Empire Building, 206 So. Main St., Rockford, Illinois
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New!

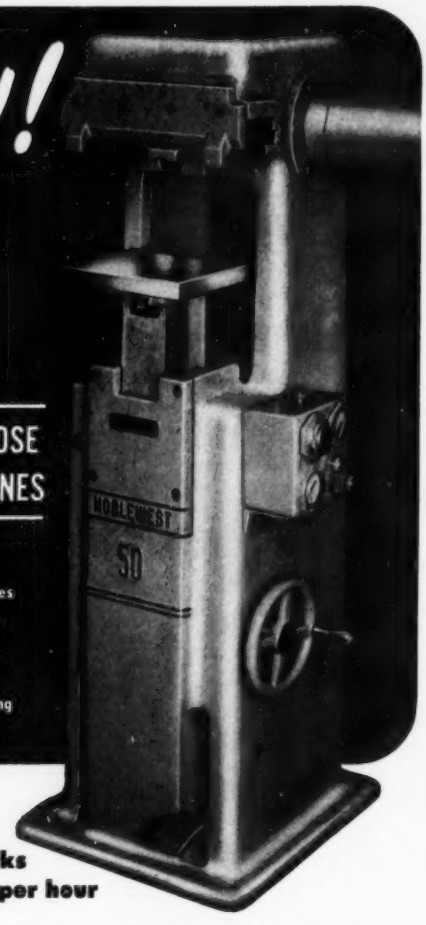
SERIES

50

GENERAL PURPOSE MARKING MACHINES

for

- ✓ Marking round surfaces
- ✓ Marking flat surfaces
- ✓ Precision graduating
- ✓ Serial numbering
- ✓ Knurling and embossing



ROLL-O-MARK All-pneumatic (Model 50P1) marks up to 1200 pieces per hour

Here is the leader in the all-new Noblewest Series 50 marking machines. The *Roll-O-Mark*—with all-pneumatic operation—marks with greater speed and economy than any other medium priced general purpose marking machine. It employs the original Noblewest *roll-marking* process—producing sharp permanent impressions that will last the lifetime of the piece. Ideally suited for trade marking, part or patent numbering, codifying and serial numbering. Series 50 is also available in semi-pneumatic and manually operated models. Write today for catalog containing full information and specifications. Better still, tell us your specific requirements and we can make complete recommendations. The Noble & Westbrook Manufacturing Co., 17 Westbrook Street, East Hartford 8, Conn.

MARK IT BEST WITH NOBLEWEST IMPROVED MARKING DEVICES

NOBLEWEST

EQUIPMENT FOR MARKING · GRADUATING · EMBOSSING · NUMBERING

Cosmoline

A misunderstanding seems to persist in editorial circles regarding use of a trade-marked product name for a rust preventive which has been and is being used as a generic term. We refer to "Cosmoline," which has been this company's registered trade mark for rust preventives since 1881. Of late this name has been applied by writers and editors to the old-type heavy grease preservatives only, often with an accompanying comment that "Cosmoline" is on its way out, being replaced by thin-film protective coatings or vapor-phase inhibitors.

Houghton's series of Cosmoline-branded products includes—in addition to the heavy inhibited petrolatum types conforming to USA 2-82C and 2-84B—a variety of thin film resin-solvent types, polar types, inhibited lubricating oils, waxy film and water-soluble grease types.

Therefore, if slighting references are made editorially to "Cosmoline" even though unintentionally, it is unfair to us as a maker of all types of preventives thus branded.

D. J. Richards
Vice President—Sales
E. F. Houghton & Co.
Philadelphia, Pa.

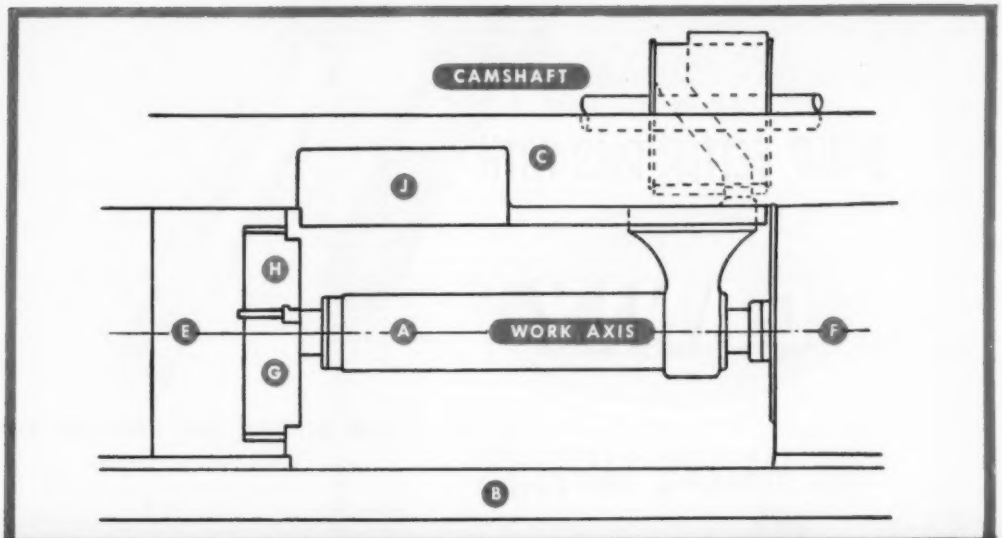
We haven't been guilty, but are glad to cooperate in spreading word—ED.

Tip to "Tips"

Suggest continuation of "Tips to Top Shop Men." These are excellent and constructive . . .

Chas. J. Church
Lathe Foreman, E. W. Bliss Co.
Hastings, Mich.

We have planned for some time to combine the first 250 or 300 Tips into a pocket-size, inexpensive, paper-covered booklet—and meantime to continue the series, of course. Are other readers interested in such a booklet, for distribution to foremen and supervisors, etc.? Some of these Tips were thus used during World War II in various aircraft plants and in the Western Ordnance District. The series will be continued, whenever we can find space, as long as suitable Tips come to mind.—ED.



THE *good* THAT MEN DO

The horizontal design Tooling Area, shown above, is a contribution by Frank L. Cone to the improvement of the Multiple Spindle Automatic Bar Machine that will live long after him. The advantages, stated below, are made possible by the machine's Overhead Camshaft. Specific data invites comparison.

THE TOOLING AREA OF THE CONOMATIC (1½" Six Spindle):

1. **Handles longer work than can be handled by the tooling area of any other "automatic."**

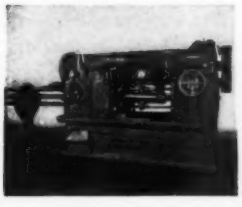
   The length of the Tooling Area is 46 5/16 ins., which permits standard machining operations on work up to 18 ins. in length from the face of the cut-off tool.

2. **Is more strongly supported by the machine frame than is the tooling area of any other "automatic."**

   The stocky Uprights, E and F, which are shorter than those of other "automatics," are securely bolted to — and held between — the Top Bed, C, and Base, B, which are larger and heavier than such members of other "automatics." *The Uprights are 22" high. The Top Bed is 8" high, 23" wide and 103¼" long. It weighs 1232 lbs. The Base is 33¼" high, 46" wide and 110" long. It weighs 6655 lbs.*

3. **Provides more Tooling positions than does any other "automatic."**

   The Main End Slide, A, has 6 positions. The Main Cross Slides, G and H, front and rear, have 6, and the Auxiliary Cross Slide, J, front and rear, are 2 more, which make a total of 14.



Buyer's Comparison Chart will guide you to full information

A Comparison of ALL Automatics is in Favor of Cone

Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

BUILD BETTER DIES WITH

DANLY®

DIE MAKERS' SUPPLIES

CAP SCREWS AND STRIPPER BOLTS

. . . knurled socket heads assure easier, faster driving.

PRECISION DOWEL PINS

. . . hardened (58-60 Rockwell C) and ground—resist upsetting in driving.

DANLY®

DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue, Chicago 50, Illinois

CALL ON THE DANLY BRANCH CLOSEST TO YOU FOR FAST LOCAL SERVICE

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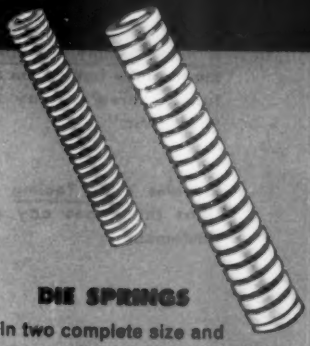
*GRAND RAPIDS, 113 Michigan Street N.W.
INDIANAPOLIS 4, 5 West 10th Street
*LONG ISLAND CITY 1, 47-28 37th Street
*LOS ANGELES 54, Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2, 111 East Wisconsin Avenue
PHILADELPHIA 44, 18 West Chelten Avenue
*ROCHESTER 4, 16 Commercial St.



DIE SPRINGS

. . . in two complete size and pressure ranges to simplify die design.

*Indicates complete stock.

SPOT NEWS of Metalworking

- **Method has been developed for direct plating of chrome on aluminum** without usual intermediate plating operations. High speed method permits deposition of 0.008 in. per hr. Process may also be applied to titanium and magnesium.

- **Military truck weaknesses in Korean war** indicate need for following improvements in combat trucks: torque converter power train, alternating current electrical system, reinforced steel beds, improved cargo truck cabs, and increased power. Frequent complaint is breaking of front springs, too weak for Korean terrain. Random survey of wrecked Russian-built trucks disclosed no spring failures. Notwithstanding weaknesses, experts are more than satisfied with job done by trucks in Korea, 80% of which served in Pacific campaign.

- **Plymouth Division will build hulls for Grumman Albatross** amphibious air rescue plane at Evansville, Ind., plant. This is Chrysler Corporation's first major airframe project. Assembly of cars at the plant will continue until machinery needed for the airframe assignment is ready.

Resistance to corrosion greater than that of chrome-nickel steels is big advantage reported for new process for production of gray alloy castings with silicon content of 13 to 17%. Process was developed by Liezen foundry in Styria, Austria.

- **Fifty-five percent of nation's aluminum fabricators have been violating** NPA orders, Federal Trade Commission survey shows. Bulk of violators either were ignorant of meaning of materials controls or didn't even know there were any. Only seven serious cases turned up, and these will provide first subjects of long-awaited crackdown on compliance. FTC is now making spot check of copper fabricators for NPA.

- **Special jet engine test program being conducted for Air Force** by General Electric reveals that engine inspection and maintenance has taken less than half the time needed for piston engines under similar conditions. In more than 70 flights, not a single case of loss of combustion in jet engines was uncovered.

- **Brazilian newspapers giving considerable space to statements by Preston Tucker,** manufacturer of ill-fated Tucker car, who hopes to promote a manufacturing operation in Brazil. He has been quoted as saying that if he gets official permission to import machinery worth $1 million and a five-year tax exemption he could manufacture automobiles at a rate which would reach three million units annually at the end of four years.

Austenite alloy formed during prolonged heating of low-carbon manganese nickel steel is subject of study by Naval Research Laboratory. Data obtained indicate that if austenite decomposes during cooling, tensile ductility and impact resistance will be decreased; if austenite is retained, it will decrease yield strength; if it transforms during plastic deformation it will increase tensile strength, lower elongation and reduction of area, and reduce notch toughness.

- **Pontiac Motor Division has $57 million contract to make medium caliber cannon.** Some 1800 operations will be performed on the guns at Pontiac, Mich., plant, utilizing about 1250 machine tools. Approximately 1190 parts and assemblies will come from 500 outside suppliers.

- **Glass can be soldered to metal by new General Electric process,** producing a bond stronger than the glass itself. Metal can be soldered to ceramics and carbon by same method. Glass and metal areas to be soldered are painted with thin layer of titanium hydride, and solder placed on both painted areas. Parts are put together and heated under vacuum to about 900 F. New technique is used for aircraft ignition systems, may be applied to production of transformers, capacitors and electric motors.

PICK THE BUSHING TO FIT THE JOB...

Order from EX-CELL-O's Stock!

Several types of Ex-Cell-O Drill Jig Bushings and liners are used in the box type jig pictured above. The Ex-Cell-O Bushing Catalog will help you select the right bushings for your jobs, and you can be sure of prompt shipment of standard bushings from stock. Standard bushings with Special hole sizes are stocked in Detroit in semi-finished form, and can be finished quickly to the exact size you require. You'll find that the uniform accuracy, finish and hardness of Ex-Cell-O Bushings prolong the life of both the bushings and the tools used with them.

FAST SHIPMENT FROM STOCK IN FOUR CITIES: In addition to a stock of over a quarter of a million bushings being renewed constantly in Detroit, standard bushings also are stocked for immediate shipment at Ex-Cell-O Corporation, 53 Park Place, New York; Machinery Sales Co., 2838 Leonis Blvd., Los Angeles, Calif., and Williams & Wilson, Ltd., 11 Front St. E., Toronto, Ontario, Canada.

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CUTTING TOOLS • AIRCRAFT ENGINE PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

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EX CELL-O for PRECISION

Let This Catalog Help You . . .

This Ex-Cell-O catalog, Bulletin 35371, will help you pick the right bushing to fit the job. A copy will be sent to you on request without obligation.

Washington

Who will get metals for what is still up in the air, despite the formal announcement of a Controlled Materials Plan starting July 1. And you're not likely to get the final word very soon.

• • •

Hitch is: How much civilian production can we have? CMP this time won't channel all critical materials into military and supporting output. So someone must say how much metal will go into those programs, how much is left for autos, appliances, furniture and the like.

The controllers can't make the decision. It's too hot politically. So the President probably will do it. And that may take weeks.

• • •

Here's how the controllers will shape CMP. First, they'll set aside steel, copper and aluminum for military production and some—not all—expansion of industrial capacity. Badly needed raw materials, like steel, will get in this top priority bracket.

Consumer durables will get no allocations. But all other programs, except the military and expansion of raw materials, will be trimmed to insure a supply of "free" (unallocated) metal for civilian-type hard goods.

• • •

Status of other production is uncertain. Handling of so-called essential goods and services, including industrial machinery and equipment, depends on the decision on how much consumer goods. The "essential" programs will be cut back either by postponing new plant or by slowing output to provide metal for civilian items.

• • •

That's why no one can be sure of CMP allocations. The metals-use reports you file in May with National Production Authority are preliminary. NPA will total up the reported demands with the military needs, subtract them from available supply of metals. Result will show little metal—if any—left for civilian goods. So, when the level of consumer goods is fixed, some "essentials" will be slashed—or get no allocations at all.

• • •

Meanwhile, NPA is gearing its staff for CMP. The breaking up of the old Industry Operations Bureau into four new organizations sets them up to serve as claimants for CMP materials.

Machinery makers and users have a new claimant. But they'll find the new Industrial and Agricultural Equipment Bureau manned largely by personnel of NPA's old Machinery Division. The bureau will call the turn on controls for both finished equipment and components.

Machinery orders will follow World War II pattern. They're being readied now by Franz T. Stone, NPA Equipment Bureau chief, who was an official of WPB machine tool and equipment agencies.

• • •

Allocations for most industrial machinery are in the works, but they can't be set until amount of metal available is known. One plan: Allocate 100% of all industrial equipment requirements and let restrictions on other production fix the demand for equipment.

• • •

Invisible profits controls are being talked. They would show up in handling appeals for relief on price ceilings. Office of Price Stabilization would reject your request if your industry as a whole has been earning over 85% of its 1946-49 average. OPS knows this formula may be unfair to some, but may use it until it gets a more equitable plan.

• • •

Wages will rise and strikes will increase now that the Wage Stabilization Board will handle labor disputes, too. That is industry's warning to President Truman for yielding to organized labor's demands and the recommendation of his new advisory board.

Actually, the wage and strike trend is upward anyhow. Plans to raise the 10% wage-increase ceiling have been in the works. New cost-of-living wage escalator clauses will be approved. And above-ceiling increase will likely be allowed to railroad, shipbuilding, textile, meat-packing and other workers.

Strikes rose sharply after Korea. Last year's 4843 stoppages were exceeded only in 1944 and 1946. This year, strikes are running double last year's figures. Big issue: Wage increases.

• • •

Labor disputes which go to WSB will be limited to two kinds: (1) Those submitted by agreement; (2) Those certified by President Truman as substantially threatening national defense.

• • •

Smaller shops will get a break from new plans to spread out military orders, Munitions Board promises. The Board is assigning a staff of small business specialists to see that the policy is followed up by procurement officers.

Contract negotiation in favor of small plants is the key to the new plans. Certificates of necessity for tax relief will be recommended in some cases. Price differentials also will be paid to help small firms compete. Other points: Wider subcontracting and splitting of orders into small lots for multiple awards.

Lowest Cost Way TO DE-BURIZE up to 300 Gear Teeth per minute

MODEL NO. 380-A

Cut finished gear costs and raise output at the same time—with Sheffield #380 Series Gear Deburizers which offer the following advantages.

★ Burr or chamfer spur, helical, hypoid, bevel and herringbone gears, also, multiple start worms, up to 7" O.D. (Model #381 will handle gears from 6" to 12" O.D.)

★ Operate on automatic or continuous cycle generally without clamping the work gear.

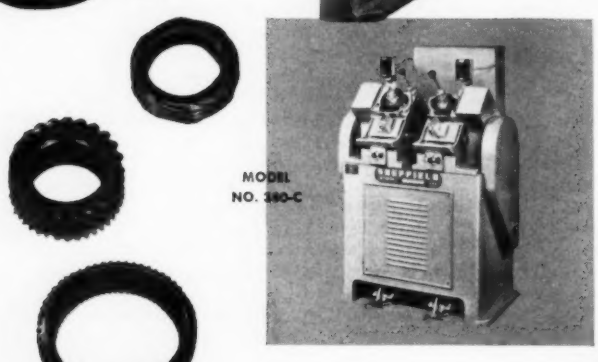
★ Use simple, low cost standard tool bits which are easily sharpened on the face angle only.

★ Interchangeability of tooling with minimum down time.

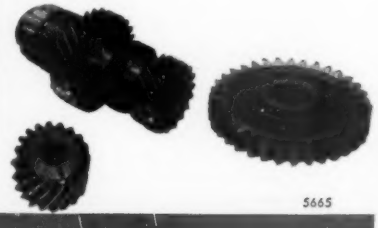
★ Small, compact, low cost machine requires minimum of setup and changeover time—and practically no maintenance.

★ Direct drive assures positive indexing.

Write for specifications #B-380-50 —or call your Sheffield Representative.



MODEL NO. 380-C



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GAGES • MEASURING INSTRUMENTS • MACHINE TOOLS • CONTRACT SERVICES • PRECISION TOOLS

Detroit

"When," asked a man in the Cleveland audience, "will those automobile cutbacks we've been hearing about come in Detroit?"

The veteran automobile reporter meditated. "Since early December," he replied, "I've been told by reliable contacts that trouble was ahead — a matter of a few weeks. Instead, practically every week has been setting a new record. I don't know when — if ever — the cutbacks will come.

"And that goes," he added, "steel quotas or not. They keep seeming to find their way around their problems. Eventually steel will throttle them back—probably soon. But I've stopped expecting it tomorrow."

• • •

That's about as good an analysis of what's been happening in Detroit as you'd get anywhere. Output did slump off to 150,000 or so a week in mid-April, down 25,000 from earlier figures. But 150,000 or so is a colossal week's production by any except 1950 standards.

• • •

Here and there are trouble spots—radiator shortages at Kaiser-Frazer, lack of sheet metal at B-O-P branch plants, fewer automatic transmissions in other GM divisions. But a horizontal cut across the industry still lies ahead.

Sales, meanwhile, are slower than the companies would like to see them—but not so slow as to affect schedules. Dealer stocks are climbing, but that's natural right now, at the threshhold of the spring market. A few weeks of warm weather will start field stocks downward.

• • •

Used car dealers are wailing loudly—not unexpected after the past few years of new car business. Their wail: "We can't sell recent model cars." Total second-hand sales are surprisingly high, but it's the under-$1000 cars that are in demand. People with 1949's or 1950's to market are having troubles—at least before the warm weather fillips the business.

• • •

Employment stays substantial in Detroit. Skilled men, competent machine hands are as hard to find as ever. Maybe harder. No company yet, though, is finding itself man-short to the point of interference with schedules.

• • •

Buying policies of Detroit purchasing agents are heading toward the longer term. A survey shows that 63% were buying three months or longer ahead. In February, 50% fell in that category. Inventories seem to continue to creep up—a natural outgrowth of the finding of purchasers that commodity prices are still going up while business stays as good, if not better, as it was earlier.

The big black market in nickel is quieting. It started when the government modified its policies on nickel use, importantly affecting automobiles. The first order required producers to cut back their inventories, so many sold nickel in the open market at going prices. Cheaters did not.

Then the government changed its order, permitting use of whatever inventories were at hand. Those who had been honest and disposed of their inventories screamed bloody murder. Nickel anode prices rose sharply. One Detroit company which sold a 32,000-lb car of nickel for 68¢ learned later that the buyer had been offered $3 a pound while the shipment was still enroute.

• • •

Steel black markets are continuing around Detroit; gossip is that they are about 66% higher than published prices. Anecdote: A small company official with a large stake in a small steel producer couldn't get any steel anywhere, even from the mill in which he had an interest. He bought a good tonnage at 16½¢ a pound—specification material which normally would have cost him around 11¢. When it arrived he found it had originated at his own mill!

• • •

Civilian automobile tooling keeps coming out, although it is evident that at this point the end of the 1952 programs is at hand. Nobody has seen anything remotely resembling 1953 work. The assumption generally is that this will be the last model change that means anything in quite a while—or at least that appears to be the thinking of the automobile makers.

Some details on the tank engine program of Chrysler Corp. at New Orleans have come out of the deep south. Tooling for the plant, which will build Continental Motors design power plants, involves 1350 machines, 8400 fixtures, 8500 tools, and 7500 gages. About 500 companies will supply these items, along with heat treating furnaces, washers, paint booths, conveyors, and service piping.

• • •

To manufacture armored vehicles, Ford has set up a tank division. Its first assignment: Supervision of tank manufacture at the new plant to go up at Livonia, Mich. General manager: A. C. Moore, former manufacturing manager of the tractor and industrial engine division.

• • •

A new English-built Ford, the Consul, is the latest foreign car to enter the American scene. Strictly "small car," the Consul has a 47-hp engine with 3⅛-in. bore, 3-in. stroke. The one model — a 5-passenger, 4-door sedan — is smartly styled in the modern manner, has top speed of 70 mph, delivers up to 37 mpg.

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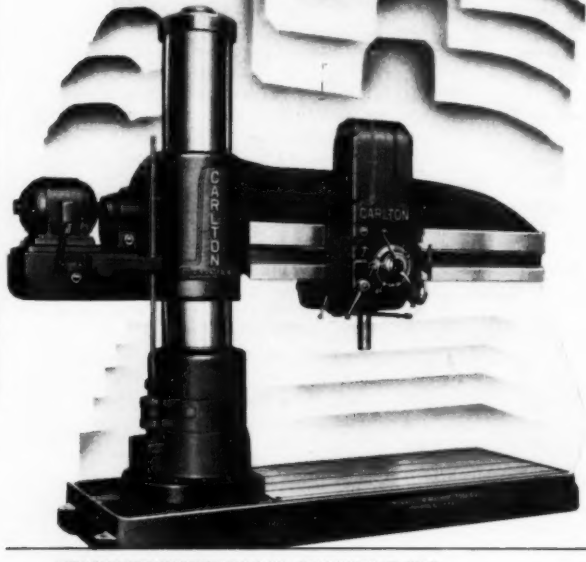

In the broad Carlton line there's a radial that will drill and tap any holes you may have from ¼" to 10" diameter. Between the 5A with 26" column and 12' arm . . . and the 1A with 9" column and 3' arm . . . there are five basic models and many different column and arm sizes. With this variety you can buy exactly the right size Carlton for your requirements.

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- ☐ 3A— 13" col. 4'-5' arms; 15" col. 4'-5'-6' arms; 17" col. 5'-6'-7' arms
- ☐ 4A— 19" col. 6'-7'-8' arms
- ☐ 5A— 22" col. 7' to 10' arms; 26" col. 8' to 12' arms

NAME_____

ADDRESS_____ CITY_____ STATE_____

Machine Tools

Machine tool builders probably will be covered by the new machinery order on prices before you read this page. This order provides for a roll-back to pre-Korea, to which can be added increased labor and materials costs since Korea.

• • •

Main features of the price order are about as follows: The builder may choose as a base the highest price charged in any calendar quarter in the year ending June 25, 1950.

He may select a different quarter for each line, but once he picks a quarter, he has to stick with it.

He can calculate increased materials costs up to April 1, 1951. Indirect as well as direct factory labor costs (including engineering) may be computed to find total allowable increases.

It is likely that some provision will be made for including extra subcontracting costs. If not, a separate order on subcontracting will come out later.

Premium costs for overtime pay apparently are not covered in the order. The builder is expected to absorb them.

• • •

A separate metalworking equipment order is in the works. But it will not be out for awhile (The machinery order takes in all kinds of industrial and farm machinery). Details of how it will differ from the machinery order have not yet been ironed out.

• • •

The absence of any kind of satisfactory price formula in Washington has kept the machine tool industry in an uproar. A substantial percentage of builders have refused for several weeks to accept orders from customers until they know where they stand on prices.

This pile-up of orders has reached the staggering size of $250 million, according to reliable estimates. The price dilemma also affects pool contracts awarded by the General Services Administration.

• • •

What's worse about the price situation, builders are cancelling subcontracting arrangements as they become convinced that Washington does not intend to make a fair allowance for this kind of premium work.

Subcontracting costs run a minimum of 25% above the cost in the builder's own plant. And sometimes the cost is twice the builder's cost.

This deplorable situation is bound to have a dampening effect on machine tool production at a time when it should be climbing rather than standing still.

• • •

Five press builders have received pool contracts: Clearing Machine Corp.; E. W. Bliss Co.; Hydraulic Press Mfg. Co.; American Steel Foundries (Elmes Division); and Denison Mfg. Co. These press contracts run to $7,089,000.

Number of companies receiving pool orders now stands at 22, of which 17 are machine tool builders. Some $87 million is involved.

Four more pool orders are in process of being placed. They total $12 million. That brings all pool contracts for machine tools and presses to $99 million, or almost all the money which is in the GSA "kitty" for pool order purposes.

• • •

The fact is that the pool order program is bogged down. There are not likely to be any more orders until the $1 billion supplemental appropriation bill passes Congress. That probably will be a matter of weeks.

The truth is that this bill does not have any funds actually earmarked for machine tools. And some of the top NPA officials regard the pool order program with coolness and wonder whether it is necessary in its entirety. But NPA's Machinery Division is confident that more pool orders will be distributed soon.

Many builders have said that they do not wish pool contracts. But NPA believes that they make such statements with tongue in cheek.

• • •

Charles A. Simmons, Sr., has been named advisor on used machine tools by OPS. He is president of Simmons Machine Tool Corp., Albany, N. Y. He will spend two or three days a week in Washington until price ceilings are established on used machine tools.

• • •

Machinery Dealers' National Association has moved its national office to 1346 Connecticut Avenue, N.W., Washington 6, D.C. The office formerly was in Chicago. J. M. P. Fox is executive director of the association.

An industry advisory committee for the used machinery industry has been appointed. Its first meeting was set for April 23.

• • •

Certain people in the Air Force at Wright Field have been trying to get some machine tool builders to knock the dealer's commission off prices. Certain distributors are alarmed enough that they think an educational campaign to convince key government officials of the importance of the distributor would be excellent.

• • •

Italian machine tool builders are soliciting business in this country. A letter has gone out to prospective customers from F. Carbonetti, Italian commercial attache at Chicago, suggesting that the builders be contacted direct or that his office supply further data.

If broaching isn't the answer, we'll tell you, too.....

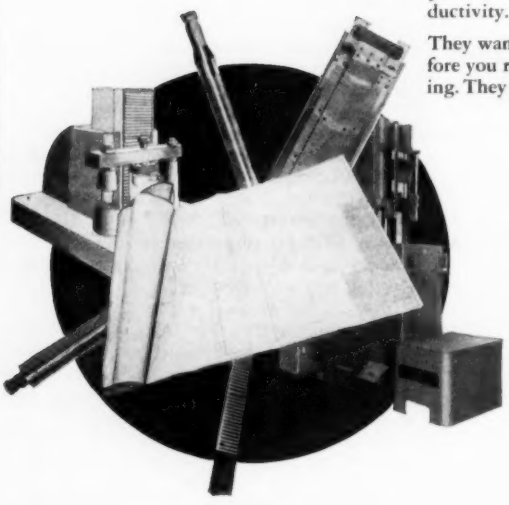
The fact that broaching accurately removes metal faster than any other process does not make it a panacea to increase the productivity of ANY operation.

Naturally we want to see broaching used wherever possible. But, today especially, with productivity for defense so vital, we *don't* want to see it used where it shouldn't be used and we *do* want to see it used to its maximum effectiveness.

Colonial's broaching specialists have been through the mill for years on practically every kind of broaching job there is. They know where broaching can and cannot be used effectively. What is more, they know HOW it can be used MOST effectively.

They have learned the hard way that the wrong broach, fixture or machine—even if it costs a few dollars less—is poor economy. It costs more in the long run, cuts productivity.

They want to help you make doubly sure you are right before you release an order for broaching equipment or tooling. They will check your requirements without cost to you.



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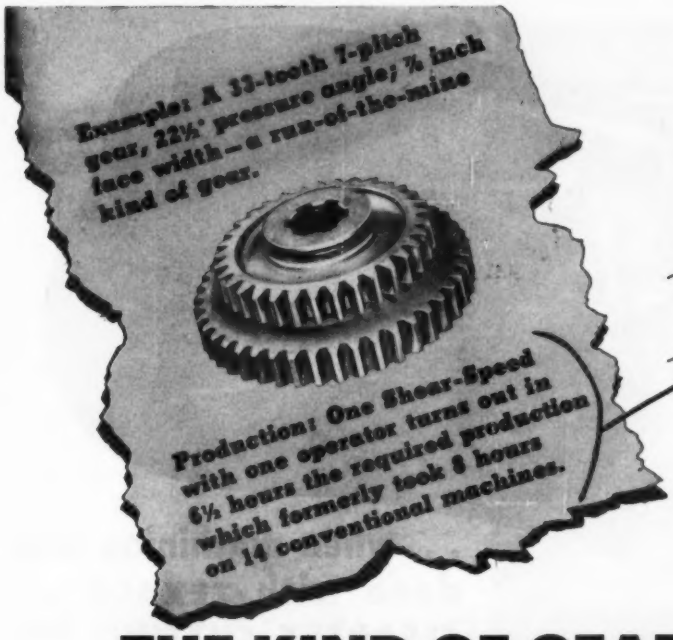
COLONIAL

BROACH CO. DETROIT 13

For Your Tool Room

A wall or bulletin board poster of DO and DON'T items that should help you reduce broach maintenance cost. No charge. Ask for BN-1250.


Example: A 33-tooth 7-pitch gear, 22½° pressure angle; ⅞ inch face width—a run-of-the-mine kind of gear.
Production: One Shear-Speed with one operator turns out in 6½ hours the required production which formerly took 8 hours on 14 conventional machines.

14
x8
112
-6½
105½ hrs. saved per shift!

THE KIND OF GEAR-CUTTING YOUR TOP MANAGEMENT "WILL GO FOR", TOO . . .

Any time you can up productivity per machine hour and man-hour *that* much, top management *is* interested.

The reason you can do this with a Shear-Speed is that it cuts all the teeth at once. The Shear-Speed doesn't care how many teeth there are or how big the gear is. Pitch and face width—total metal removal—are the only things affecting cutting time.

It's something worth talking to the big boss about. But before you do, get all the facts.

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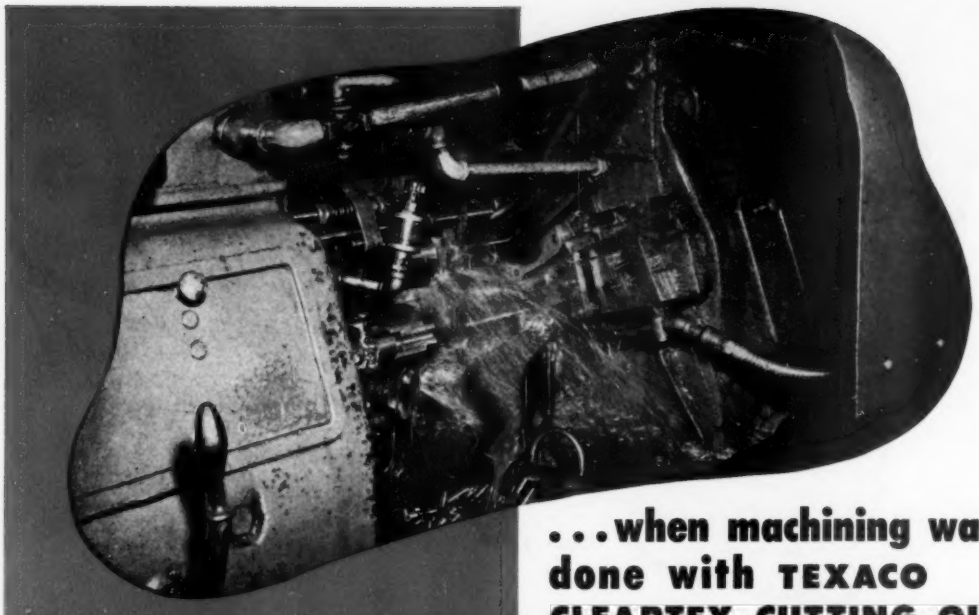
I would like to know more about the Shear-Speed

Name_____

Title_____

Company_____

Address_____



130% GREATER PRODUCTION between tool grinds...

...when machining was done with TEXACO CLEARTEX CUTTING OIL

In this plant,* steel parts for pumps were being machined on Acme Gridley automatics. Two different competitive oils were being used — one as cutting fluid and the other as machine lubricant. Production lagged because of frequent tool changes, and contamination of coolant by machine oil necessitated frequent oil changes.

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Machining stainless steel on the same set-up, use of *Texaco Cleartex Cutting Oil B* increased production between tool grinds 42%.

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*Name of this Texaco user on request

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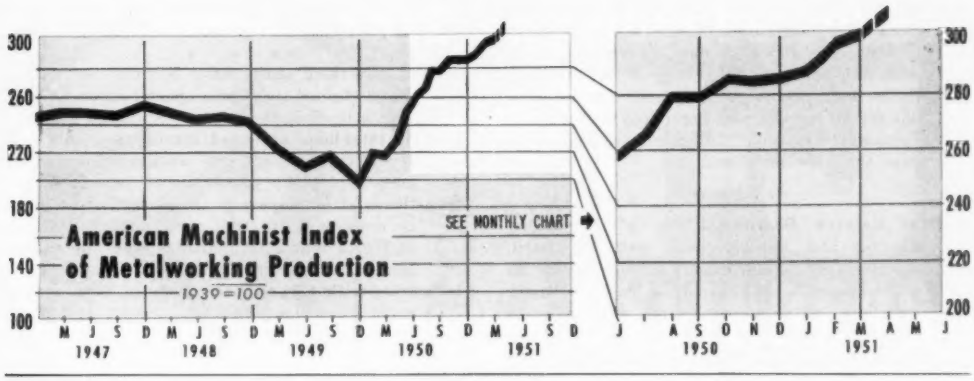
Gaging Metalworking



Defense Output Spurs Metalworking

Metalworking is climbing as defense production slowly grows and is mostly superimposed on civilian output. The falling off in assembly of consumer goods is not yet impressive and probably won't amount to much until after midyear.

High government officials privately predict that actual outlay of dollars for defense will get up to a $4-billion-a-month rate by the end of the year. It will stay at or colse to that level throughout 1952 and 1953.

That means that peak dollar expenditures will be attained within the next seven months. But remember that those dollars will be buying clothing and food as well as munitions.

Defense Production Administration has made available approximately 1.4 million product-tons of steel for month of June for 24 special programs needed to expand production for defense-supporting and essential civilian needs.

Some of the more important special programs approved for June: U.S. freight car, 308,000 product-tons of steel; U.S. locomotive, 40,000 tons; oil country tubular goods, capacity output, estimated at 140,000 tons; Defense Electric Power Administration, 90,000 tons; heavy power equipment, 95,000 tons, and Maritime ship construction, 31,000 tons.

• • •

Peak production of military hardware—planes, guns, tanks—will come much later. Munitions output will not be felt much until third quarter and will not gather real momentum until the final quarter. It will expand steadily and should reach top volume the middle of next year.

Complaints of materials shortages are loud, but the fact is that inventories of steel, work in process and finished goods are larger in many cases than manufacturers like to admit.

Certain mill supply houses have warehouses bulging with goods. They have financed these stocks to the limit of their ability. And they actually have issued "stop" orders to their suppliers on further shipments.

• • •

The steel situation looks more promising. If the first quarter output is an accurate gage to what happens later, steel production this year will be 7 million ingot tons greater than in 1950. This increase is coming not from brand-new facilities (which won't be ready until 1952), but from getting more tonnage out of existing equipment, plus better-rounded integration—a new open-hearth here, a cold finishing mill there.

INDEX	APR. '51	MAR. '51(p)	FEB. '51(r)	MAR. '50
	309*	301	297	220
Machinery		294	293	213
Electrical Manufacturing		336	333	258
Automobiles, Trucks		257	256	195
Transportation Equipment		351	343	214
Other Metalworking		307	299	242

AMERICAN MACHINIST'S Index of Metalworking Production is based on manhours worked in the five components above.

* Estimated (p) Preliminary (r) Revised

Gaging Business

AMERICAN MACHINIST Index of Metalworking Production heads up from the 300 level (1939 = 100). April is estimated at 309, compared with 231 for April 1950. Biggest increase was in the Transportation Equipment component—351 for March this year compared with 343 for February. All other components were also up over the previous month.

• • •

Federal Reserve Board's survey of consumers' finances and buying plans, just completed, indicates consumers expect to buy nearly as many homes in 1951 as in 1950. However, there will be a shift in demand from new homes to existing houses.

Consumers plan to buy fewer new and used cars. Otherwise, they expect to purchase durable goods at about same rate as last year.

However, softening of consumers' demand was based on expected price increases. If price controls work, demand for autos and appliances may exceed production later this year.

• • •

For past few weeks, wholesale prices have stopped rising. Since the wage price freeze took effect, prices have gone up only 1.7%. Prices are still 17% above pre-Korea.

Price stabilizer DiSalle believes retail prices may already have reached the peak. This is two or three months earlier than OPS had expected. Just the same, new pricing orders will keep coming.

The new manufacturers' pricing order gives a manufacturer with gross sales of less than $250,000 a year the option of using the current ceilings up to December 31, of imported materials up to March 15, and of labor to March 15.

• • •

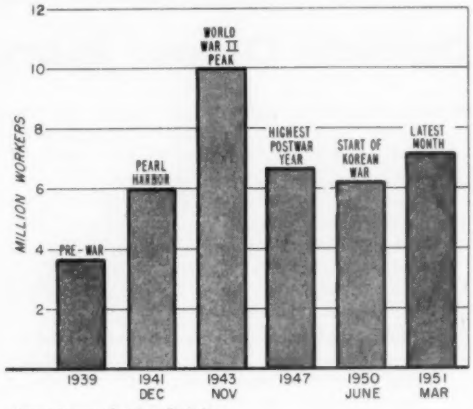
Second and third shifts have become common in metalworking industries, special survey of 6000 plants by Bureau of Labor Statistics shows.

Half the total labor surveyed, representing only one-seventh the plants, was working three shifts. One-third of the plants are on two shifts.

Two-thirds of employees in three-shift plants were on the first shift. That ratio is much less than in World War II. It indicates room for expansion on second and third shifts.

Industries with highest percentage of evening and night work: automobiles, aircraft and parts, tin cans, forgings.

METALWORKING EMPLOYMENT CLIMBS



Source Bureau of Labor Statistics

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1923-1925 = 100)*	229.8	230.4	202.5
Steel ingot operations (thousands of tons)	2,057	2,045	1,906
Electric power output (million kilowatt hours)	6,747	6,736	5,863
Production of automobiles and trucks	163,876	158,076	147,240
Engineering Construction awards. (Eng. News-Record—millions)	$220.8	$311.2	$185.7

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production* (1935-1939 = 100)	221	221	180
Index of durable manufacturers' production* (1935-1939 = 100)	272	269	207
Durable goods manufacturers' sales* (millions)	$10,516	$10,598	$7,103
Electrical machinery manufacturers' sales* (millions)	$1,389	$1,302	$745
Other machinery manufacturers' sales* (millions)	$1,764	$1,755	$1,115
Durable goods manufacturers' new orders (millions)	$13,773	$14,156	$7,213
Electrical machinery manufacturers' new orders (millions)	$1,745	$1,709	$726
Other machinery manufacturers' new orders (millions)	$2,824	$2,641	$1,211

* Seasonally adjusted.

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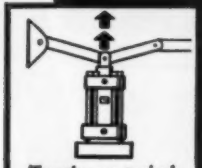
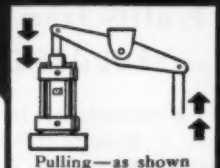
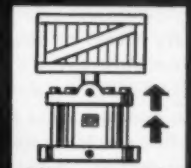
with **T-J CYLINDERS**



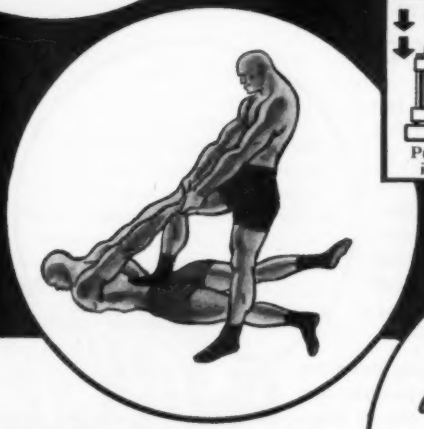
Toggle—a typical pushing operation.



Pulling—as shown in 1st class lever.



Lifting—a straight thrust movement.



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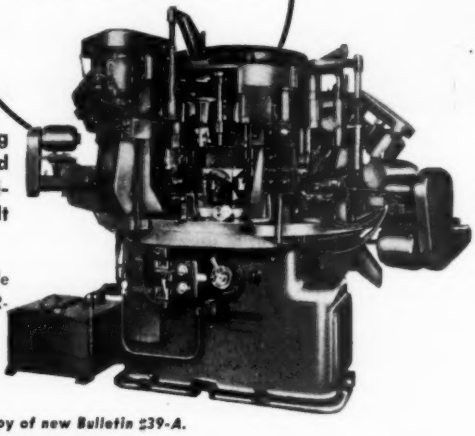
This Morris Center Column Machine taps, drills and spot faces carburetor bodies with production of 320 pieces per hour at 80% efficiency. In the same plant, two other Morris Machines save time, money and space, producing other carburetor parts.



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American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Needed: A New Price Policy

An intolerable price situation exists in the machine tool industry. Unless corrected at once, it will delay dangerously expansion of machine tool production for the defense program.

For weeks machine tool builders have been subject to a General Ceiling Price Regulation. This regulation sets as a ceiling the price at which machines were delivered, not ordered or sold, during the base period (last December 18 to January 25).

The bad effect of this policy has been to put prices at a pre-Korean level. It is bad because the time cycle in building most machine tools is so long that machines delivered in the base period were ordered before the Korean war began. Since then, labor and materials costs have risen sharply.

PRICE AUTHORITIES now recognize the inequity of this regulation. As a substitute, they have been considering the issuance of a machine tool order which would fix a maximum price based on the pre-Korean price plus increased "factory" and materials costs since then. That sounds fine. But closer inspection shows that the order leaves much to be desired. It would ask each builder to figure his added costs for every type and size of machine. That would necessitate bookkeeping on a scale that would be an accountant's dream.

Beyond that, price officials had not made up their minds, at last report, to allow for overtime pay and for extra subcontracting costs in figuring increased costs.

Yet the industry can enlarge production in only two ways: working very long hours on double shifts and subcontracting as much work as possible, including complete machines.

DILLY-DALLYING OF PRICE OFFICIALS and their apparent lack of understanding of the industry's problems have led many machine tool companies to stop taking orders until the price situation clarifies. What's more, the skepticism of price authorities toward overtime and subcontracting has chilled the enthusiasm of builders for using these effective means of getting more production. Why resort to them if the result is to lose money or emerge with no better than a nominal profit?

The situation has deteriorated so much that defense agencies are alarmed. Both the Munitions Board and the Economic Cooperation Administration (the latter being concerned with tooling for defense production in western Europe) have sent letters to Mr. DiSalle seeking a speedy and equitable solution of the price problem in the interest of expanding machine tool output quickly.

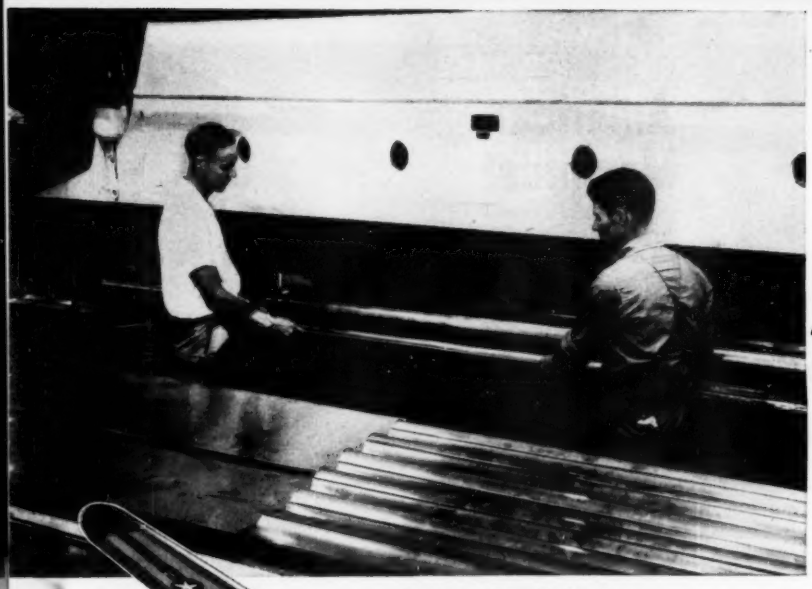
We join these agencies in urging immediate action to establish a reasonable and just price formula.

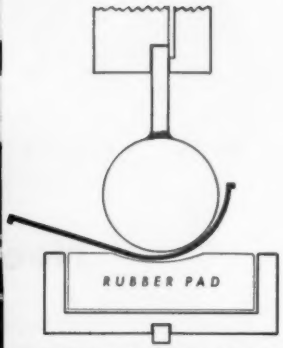
SINCE A ROLLBACK HAS BEEN DECREED, the simplest formula would be to add to the pre-Korean base a fixed percentage for increased production costs to apply to all machine-tool builders.

While this formula would be far from perfect, it would have the high merit of eliminating the need for elaborate and expensive accounting methods. It would let builders know exactly where they stand. It would be simple and workable. It quickly would clear up existing confusion.

Best of all, it would take builders' minds off prices and enable them to get on with the all-important job of producing the tens of thousands of machine tools for the defense of America and of our allies.

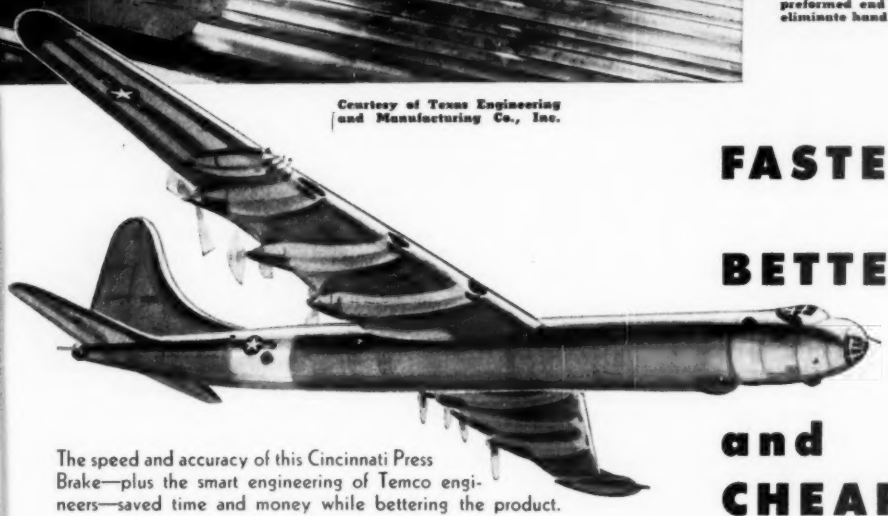
Burnham Finney





Slots cut in the rubber pad permit forming all length of ducts with preformed end seam flanges and eliminate hand forming.

Courtesy of Texas Engineering and Manufacturing Co., Inc.



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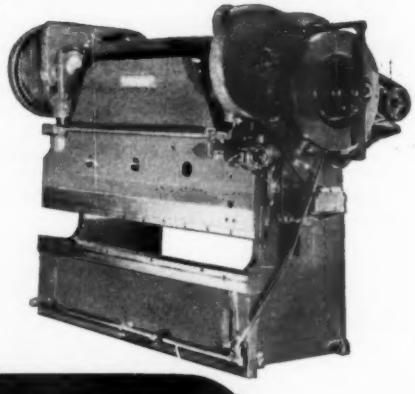

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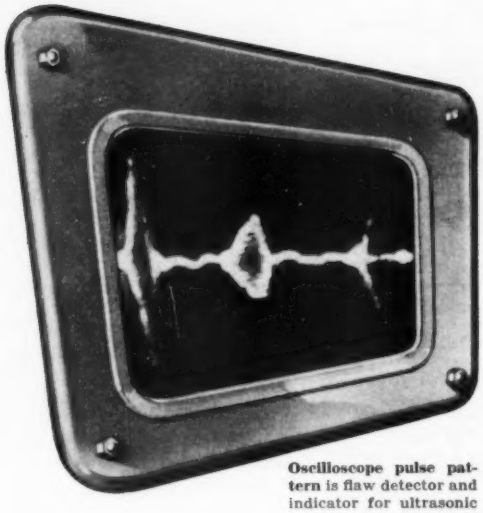


Oscilloscope pulse pattern is flaw detector and indicator for ultrasonic non-destructive testing

ULTRASONICS... METALWORKING TOOL?

BY CHARLES EMERSON, ASSISTANT EDITOR
and JOHN STARR

It was 1880 when the famous Curie brothers discovered that they could stress a quartz crystal mechanically to produce an electrical charge. This scientific seed—called the piezoelectric effect—grew into the electronics field; but it started something else, too. Ultrasonics is based partly on the Curies' discovery, but it incubated for almost 60 years before anything really practical was done. With the development of radar and sonar, however, it got going. Now it may have some interesting answers to tough Metalworking problems

"Ultrasonic" is a new word. It means sound waves that vibrate so fast the human ear cannot detect them—over 20,000 cycles per second. It used to be called "Supersonic", but aviation took over that term to indicate flight faster than the *speed* of sound in air—about 1088 fps. Speed and frequency being entirely different quantities, the word "Ultrasonic" has been generally accepted for the phenomenon.

Defining the word is a lot easier than applying the basic principles. For a sidelight on just how new this branch of science really is, consider the lowly bat:

The bat has been a scientific enigma for centuries. Nobody knew just how he managed to fly at night without smashing into trees and houses, for his eyes are notoriously feeble. Louis Jurine, a Swiss, found in the latter part of the 18th century that bats lost their ability to navigate unerringly when their hearing was impaired. In 1920, 150 years later, Professor Hartridge suggested ultrasonic vibrations as the answer. Proof of his theory had to wait until the 1940's, when Griffin and Galambos detected these vibrations. Now we know that bats emit squeaks that range in frequency from 25,000 to 70,000 cps (cycles per second). It's no wonder that bats were a mystery—nobody could hear them!

What the bat actually does is make a squeak —or a series of them—and listen for an echo. His perceptions are remarkably acute, so if a sound wave bounces back from a twig or leaf he can detect the direction and the distance of the obstacle. By squeaking—listening—squeaking—listening (all very rapidly), he can form a mental picture of his surroundings, even though he cannot see them. Thus he can avoid such tiny objects as wires; and all this is done while he is flying at full speed. He doesn't make errors because he rarely gets confused. He can shut off his hearing while he is squeaking, and can turn it on again to listen for the echoes.

The bat's squeaks are practical only to him, but his principles are of value to industry. The bat's direction- and distance-indicating skills can probably be duplicated by science, but the practical approach to ultrasonics has shown that some variations on the idea are more useful.

Transducers

Ultrasonic generators that change mechanical or electrical energy into sound energy are commercially available right now. There are four general types:

Whistles are comparatively simple and sturdy, and you might expect them to be the best of all ultrasonic transducers. However, no practical

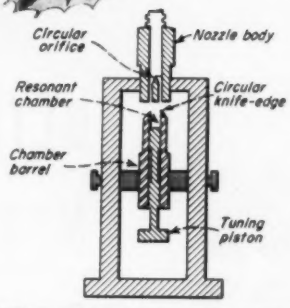
power-producing whistles have been developed as yet, although experiments are being made along this line. One of the important difficulties is low efficiency; another is trouble in maintaining the airstream at constant pressure. One whistle that is actually ultrasonic is used on Hollywood sound stages—for directing trained dog actors while they go through their paces for the cameras. This is the Galton whistle, one of the oldest of ultrasonic devices.

Sirens are more practical; in fact they are produced commercially. The main use to date is to agglomerate solid particles in smoke and industrial gases; especially to recover valuable particles from waste gases. The mechanism is normally arranged to produce intense sound waves at the interface between a rotor and stator—both having many small holes drilled through their outside edges. As air from a jet passes through the holes in the rotor and goes into those in the stator, it breaks up to form a sound pattern that is directed away from the siren by an acoustic horn — much like the horn of an outdoor public-address loudspeaker. Control of such a siren is simple; to change pitch, just vary the speed of the rotor; to change intensity, alter the pressure behind the air jet.

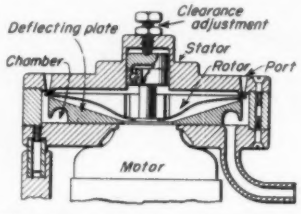
Sirens are located to send their vibrations through or into the stream of the gas. Although all particles will move at the same frequency, small ones move widely and larger ones move more sluggishly. The small ones hit and adhere to the larger ones, thus building up the average size of the particles to the point where they can be removed from the gas by a cyclone separator.

Sirens may be applied to other jobs in the future. Laboratory tests are being made currently with sound lenses and prisms—not glass, but metal-strip affairs made to beam or diffuse sound waves by refracting them. Some success has been had with audible sound, and ultrasonic waves may be controlled in the future by such devices.

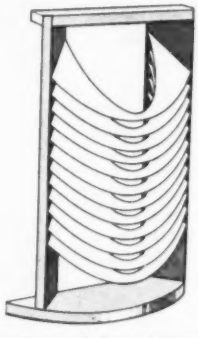
Sirens can concentrate waves effectively. As much as a kilowatt of power can be concentrated within a square centimeter of area —which is ten times the concentration of a hot lamp filament.



Galton whistle works like regular whistle, but in high-frequency range. Air pressure must be high



Siren has matching holes through rims of rotor and stator. One model has 10-hp motor to drive rotor, uses air at 8 psig, consumes 225 cu ft of air per min, produces frequencies up to 22,000 cps



Divergent sound lens designed for audible waves may be adaptable for ultrasonic waves. Elements, or lenses, are thin sheetmetal strips mounted in front of speaker

Crystals based on the piezoelectric effect are widely utilized for inspection purposes. Vibrations in all frequencies up to 500,000,000 cps can be created in the laboratory, thus crystals are practical for experiments that require ultrasonic vibrations; but not too much power. Natural piezoelectric crystals are too small to act as transducers for any reasonable amount of power, but within the last few years a number of synthetic crystal-like materials have been developed. These are made from ceramics, and are available commercially in a number of shapes and sizes. Although power output is generally low, they can be controlled accurately.

Of particular use to Metalworking are ultrasonic inspection devices, based on synthetic-crystal transducers. The idea here is to pass a high - frequency wave through a sample part and to note reflections and echoes on an oscilloscope cathode-ray tube. Just sending the wave through the part would only show a standing-wave pattern on the 'scope, so general practice is to impress a beat or impulse on the ultrasonic wave—at a rate of 60 beats per second.

The result in the face of the 'scope is a wave pattern that shows the initial beat, the reflection of the beat from the back surface of the test piece, and also shows partial reflections for any discontinuities in the piece—including such defects as bubbles in a casting, cracks inside the piece, or even—if the frequency of the standing wave of the transducer is high enough—such minute variations as crystalline structure.

An important point to remember in testing with such a device is that offhand examination of a

Synthetic piezoelectric element does crystal's work better. Shell shape throws lines of force into focus. Other shapes can concentrate, diffuse, radiate, and center vibrations

piece will result in a 'scope pattern that is difficult to interpret. You have to know what you're looking for. Take a rectangular machined block, for example: If you are examining it for large imperfections, a low ultrasonic frequency will do the trick; but if you are after small cracks, the frequency must be high. Size of the crystal head is important, too, because a larger head (say a standard 1-in. unit) will penetrate as much as 25 ft of material, depending on the structure, while a ½-in. head will work best for lengths up to 1 or 2 ft.

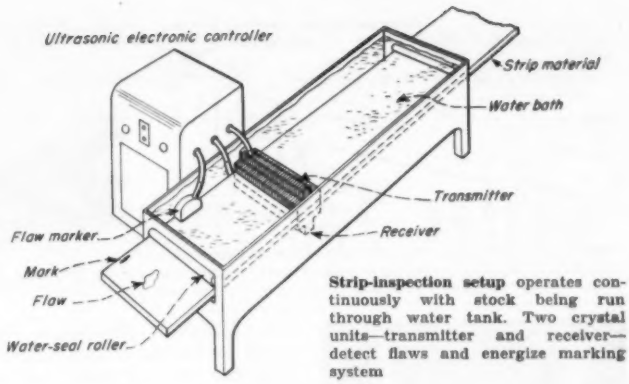
Ultrasonic testing with reflection units is not mysterious—it doesn't require the services of a graduate physicist to handle the equipment. A few hours of training for a technican familiar with other nondestructive testing methods should be enough for detecting commonly encountered flaws. As to the practicality of the method, there is no doubt. However, it is no cure-all, and might effectively be utilized with other testing methods.

In the railroad industry, reflecting units have made it possible for one line to stop removing axles after a specific mileage. Axles are replaced only after worn beyond allowable limits or when ultrasonic testing shows a defect. By count, 8383 axles and 3054 crankpins were checked, and 148 axles and 66 crankpins were replaced because they were defective—eliminating that many possible causes for derailments, but throwing out no good parts. The result was safety with economy. The railroad's experiences indicated that many other applications of the test method might be possible. The important point is that dismantling of the equipment is not necessary.

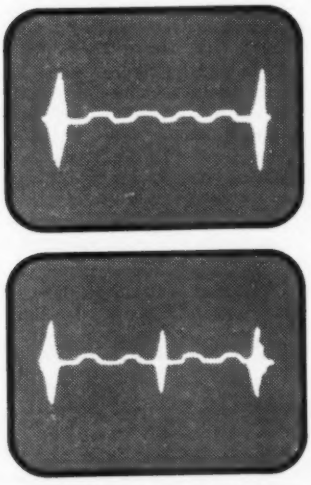
In testing aluminum ingots, reflecting units have proved valuable because tests can be made at any point during production—even after the ingots have been forged. Heavy steel forgings are tested, too, to show up internal bursts that are difficult or impossible to detect economically by any other means. Testing during production makes it possible to throw out defective forgings or casting before too much work has been done.

Crystal units are available in 2-, 1-, and ½-in. sizes, and can be set up for ½-, 1-, 2¼-, and 5-megacycle frequencies. Tilting blocks are available to direct the beam of energy at a slant through the test piece. Because any discontinuity in the path of the beam will show up on the 'scope, the crystal search unit is normally sealed to the surface of the piece under test by oil, glycerine, aerosol, or a mixture of these. This eliminates reflections from the top surface of the part and simplifies the 'scope pattern.

Ultrasonic waves from a crystal transducer can do another important job, too. Because the frequency can be accurately controlled, and because the speed of the wave is calculable through any given material, the thickness of a test part can be gaged. This is currently being done in the production of aircraft propeller blades, where the thickness of the blade wall is important, and where no destruction can be tolerated. Checking can be done with the 'scope, by measuring the span between the original pulse and its reflection

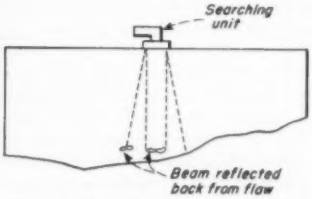


Strip-inspection setup operates continuously with stock being run through water tank. Two crystal units—transmitter and receiver—detect flaws and energize marking system

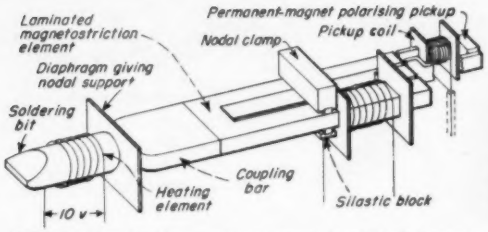


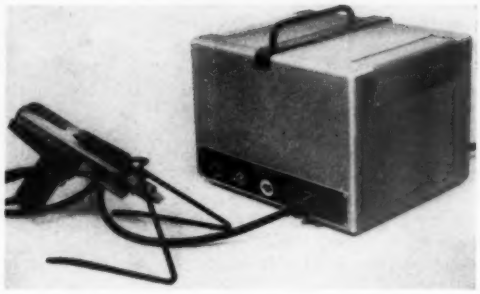
'Scope pattern for good part shows original pulse at left, back reflection from opposite side of part shows at right. Faulty part has pattern with pulse showing between edges of part, with reduced back reflection

Crystal head contacts work under inspection to direct ultrasonic beam down into work. Contact must be close, so oil seal may be required

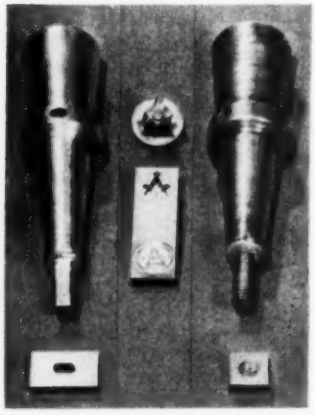


Search beam has cone shape. Reflection is from back surface, or from imperfections. Difference can be seen in cathode-ray-tube pattern





Soldering iron has drive coil that moves laminated element to vibrate heated soldering tip at high frequency. Complete iron (right) requires electronic power unit for control



Cavitation tools used in ultrasonic cutting machine form straight-sided recesses in carbide workpieces. Cutting medium is abrasive carried by fluid into holes. Screw thread is formed by tool that cuts as it revolves
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from the far surface of the blade wall, or can be done by timing the pulse to see how long it takes to reflect back; and then translating the time into thickness.

Magnetostriction transducers, the fourth classification, look like they might eventually be the big guns in the ultrasonics field. As the name implies, the device is based on electromagnetism. A coil that is energized by an electronic source at an ultrasonic frequency drives a bar or core of some other shape to produce physical vibrations. In this case, sound is actually a byproduct, and has little to do with the action of the transducer except that the frequency of vibration *is* ultrasonic.

Electromagnetic principles are well known, and the application of them to the transducer is basically simple. Because the device depends upon an electrical field, large quantities of power can be absorbed. On the other hand, because of the tremendous accelerations of the core of the coil because it vibrates, there is a practical limit on frequency; and this limit is well below that of a crystal.

As to practical metalworking devices; a company in England has developed an ultrasonic soldering iron for aluminum. In soldering aluminum, the problem is breaking through the surface oxide, or skin, that forms almost instantly when aluminum is exposed to air. This is what the ultrasonic soldering does. The vibrations of the iron break through the skin, and the hot soldering bit applies solder before the oxide can re-form and prevent proper bonding.

Ultrasonic honing has been announced, and though the machine is not commercially available, it is undoubtedly a step in the right direction. Because ultrasonic vibrations are low in magnitude and any cutting action would consist of making minute chips, heating of the workpiece should be negligible while accuracy should be high.

A cutting machine that operates much like a die-sinker has been announced as working on ultrasonic principles. This one utilizes a blunt tool of any tough material. The tool forces cavitation of the work by impacting and grinding an abrasive that is flooded into the hole or cut by a liquid. Cutting action is completely ultrasonic in frequency, and the tool is fed under pressure into the work as the hole is formed by the rapid abrasive action. Such hard materials as carbides, and such brittle materials as ceramics can be cut this way.

Future Applications

Considerable research must yet be done in the ultrasonic field, and the available devices will stand further development before ultrasonics will attain anything like the stature of, for example, electronics. But a good start has been made.

Ultrasonic testing and inspection has proven practical and valuable. Ultrasonic treatment of gases and smokes has become a reality. Ultrasonic machining, though still in the early stages of development, shows promise.

The non-metalworking fields have many examples of ultrasonic applications. Among them:

Killing bacteria in milk
Cleaning clothing
Breaking up kidney and gall-bladder stones (Done with dogs, so far)
Drying green lumber in 5 min instead of 3 weeks by kiln method
Checking water flow through turbine tunnels
Measuring silt behind dam walls

In Metalworking, ultrasonic methods show promise for:

Speeding electroplating
Measuring metal elasticity
Noiseless drilling of metals
Improving cutting action on many types of tools and machines

Our thanks go to the following companies for their help in gathering material for this article. In parentheses are the specific devices the companies are now working on or have available:

Bell Telephone Laboratories (Sound-focusing equipment)
Ultrasonic Corporation (Sirens)
Brush Development Company (Synthetic crystals, laboratory equipment)
Sperry Products, Inc. (Inspection heads and reflectoscopes)
Fisher Scientific Company (Crystal laboratory equipment)
General Electric Company (Crystal generators and test equipment)
Mullard Electronic Products, Ltd. (Soldering irons)
Cavitron Corporation (Abrasive cutting machine).

American Machinist
ARMAMENT REPORT

HERE ARE THREE ingenious methods for unusual grooving, polishing, and boring operations...Tool costs are held to a minimum and the purchase of special equipment is avoided

TOOLING TRICKS AT WATERTOWN ARSENAL

By E. L. PEARSON, Industrial Engineer, Watertown Arsenal, Watertown, Mass.

Watertown Arsenal frequently is called upon to perform operations that are beyond the range of standard machines or conventional tooling methods. During peacetime, the Arsenal carries on extensive programs of experimentation and development. Its laboratory, known for its work in ferrous metallurgy, investigates all new materials that offer possibilities for improvement both in product design and manufacturing techniques. Its manufacturing departments, often acting as pilot plants for industry, develop tooling and methods for hundreds of items of ordnance materiel. With these activities, the jobs that the Arsenal must do are many and varied. Tooling often must meet unusual requirements and operate under special conditions. Yet job quantities frequently are too low to justify a large investment in special tooling. Emphasis thus falls upon ingenuity—ingenuity to devise low-cost tools or fixtures that will do the job efficiently on available production equipment.

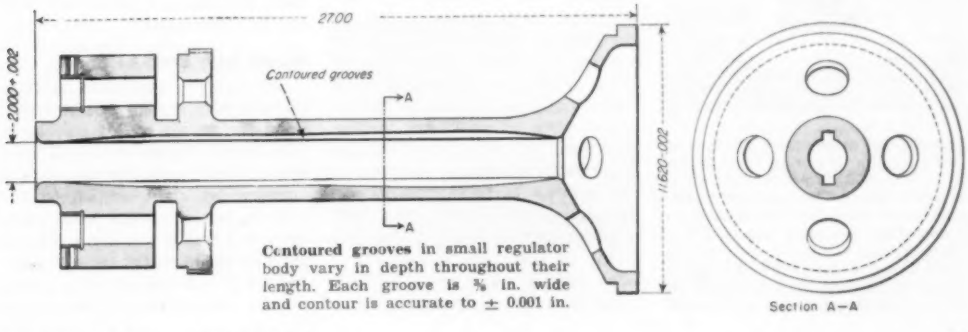
Some of these tools are applicable only to a particular job; others involve a principle that is of general application. Of the jobs recently in production, tooling on three falls into the latter class. One is a setup for contour grooving in small bores; the second is an ingenious method for directional grinding on a conical surface and three surfaces of a slot; and the third permits taper boring of pieces of much greater length than formerly was possible on lathes in the Arsenal shop.

1.. Contour Grooving Small Bores

THE contour-grooving method was developed for cutting the throttle groove in small recoil cylinders. This groove is of constant width but of varying depth throughout its length. The major difficulty in producing the contour in small cylinders is lack of space. Watertown's method overcomes this difficulty with a special toolbar that accommodates a cam within the bar. As a result, the smallest cylinder, which has a bore of 2.000 in., can be grooved readily.

In this method, one end of the part is clamped to the face of a 64-in. Lapointe horizontal broaching machine. The other end is held in a work support to which the cam is rigidly attached. In loading the machine, the work support is moved down the ways until the end of the piece is flush with the face of the support. This provides correct lengthwise location of the cam within the bore.

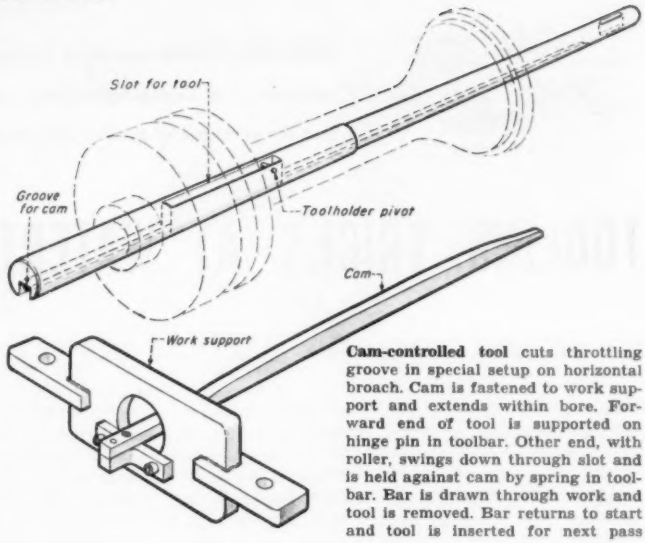
The toolholder pivots about its forward end in a special toolbar that is slotted all the way through at one point to permit the toolholder to contact the cam. The bar also is slotted almost its full length just deep enough to clear the cam



Contoured grooves in small regulator body vary in depth throughout their length. Each groove is ⅜ in. wide and contour is accurate to ± 0.001 in.

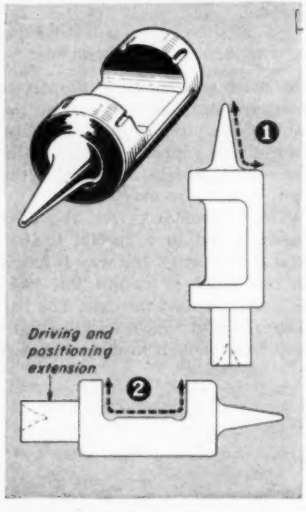
as the bar is moved through the bore. The toolbar is keyed to an adapter on the ram and the fit must be close to avoid all play. The cam is a developed form that offsets the effect of differing contact points as the roller on the toolholder moves along over the hardened cam surface.

Tool bits are HSS and are the same width as the groove. Bit position in the holder is adjustable by setscrew and is set to the exact dimension for the cut by dial indicator. After each pass the bit is advanced 0.003 in. until the limit of adjustment is reached. A longer bit then is inserted. Five bits are employed in all. The cut begins slowly, then increases in speed, the average for the pass being about 50 fpm. Coolant under low pressure is forced to the cutting tip through an oil hole in the toolbar.



Cam-controlled tool cuts throttling groove in special setup on horizontal broach. Cam is fastened to work support and extends within bore. Forward end of tool is supported on hinge pin in toolbar. Other end, with roller, swings down through slot and is held against cam by spring in toolbar. Bar is drawn through work and tool is removed. Bar returns to start and tool is inserted for next pass

2.. Directional Grinding Surfaces



Direction of grinding on surfaces of firing pin, top view, must be as shown by arrows. This is produced in abrasive-belt setups. The first grinds conical end of firing pin. Piece, held in workholder, is rotated and is moved up and down in contact with belt by cam action. Second operation grinds three surfaces in slotted section of piece, including the two small radii

ONE of Watertown's most recent manufacturing problems involved directional grinding on several hardened surfaces of the 20-mm firing pin. The conical tip on these parts is produced with a formed wheel on a cylindrical grinder. The slotted section is ground with a crush-trued wheel on a surface grinder. Grinding marks are transverse in the slot and annular on the tip. It was found, however, that these grinding marks caused stress concentrations that resulted in the failure of the part after a relatively short period of service. To overcome this difficulty, the direction of grinding must be as shown in the accompanying illustrations.

From the tooling point of view, the problem was to develop a fast method of grinding that would require little expense for tooling. The result is a setup in which pins are directional ground complete in six minutes, with the entire cost for tooling held to less than $500.

In the first operation, the square shank of the piece is inserted in a workholder, and the OD of the piece fits a bushing in a slide. When the holder is pushed forward against a stop, the tip of the piece is in contact with a belt over the full length of the cone. The position of the pins driving the belt has been carefully developed to give full-length contact and a spring-loaded shoe also acts against the belt at such an angle as to hold it in contact with the piece. The diameter of the pin around which the abrasive belt travels is the same as the radius of the work, less the average thickness of the belt. When the workholder is rotated, a cam and spring-loaded slide move the piece up and down across the full width of the belt. The belt is a plain fabric and tripoli is employed for the operation. Belt speed is about 400 sfpm for this operation.

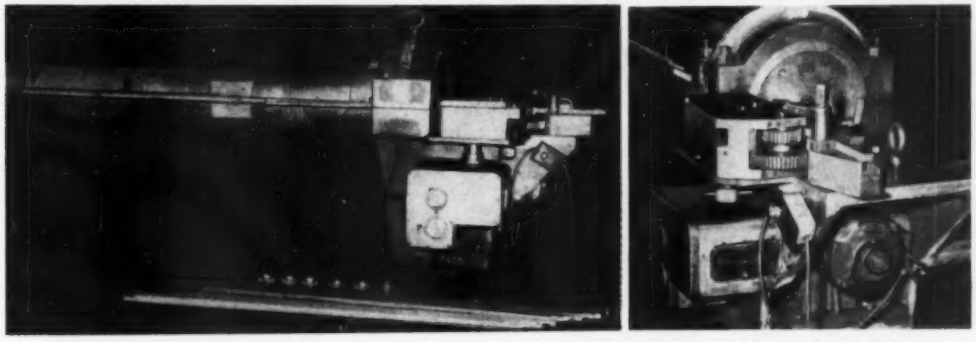
Grinds Both Radii at Once

The second operation is performed with a 400-grit abrasive belt, also driven at approximately 400 sfpm. The piece is held in a fixture that positions the slotted surfaces at right angles to the belt. A locator in the fixture acts against steps on the lower end of the belt-drive pins to insure alignment and equalize grinding action on the piece. The full contour of

the slot is ground in the one operation.

One of the most difficult parts of the operation is to obtain the directional ground finish on the two radii at the bottom of the slotted section. The abrasive belt must travel around a very small spindle to produce the finish, but not contact the pin hard enough to produce the slightest indentation. These are two of the points at which the pin breaks when in use.

The square shank on the pin is simply a driving and positioning extension left on the piece for machining purposes. This extension is removed in one of the later operations, after which this end also is directional ground.



Gear-driven boring tool requires much less space for taper boring than previous methods. Tool is fed by sectional rack gears driven by pinion in gear box. Sections of rack are disconnected as they come out of bore

3.. Rack-Driven Boring Tool

TAPER BORING can be performed at Watertown on lathes very little longer than the piece itself. This is possible because of a specially designed drive attachment that employs sectional rack gears to draw the boring tool through the tube. With this unit, pieces that are only 5 ft shorter than the lathe can be bored.

Before this method was introduced, the customary way to bore a long taper was to mount the carriage behind the tailstock. Then with a connecting strap between the toolholder and carriage, the tool was pulled through the tube by running the carriage along the ways. A machine more than twice the length of the piece was required.

In either method, the basic setup is the same. One end of the work is chucked, the other end is supported in a steady rest. The boring bar, mounted on a spherical bearing at the chuck end and in a pillow block at the steady-rest end, is offset for the correct taper. The boring tool is clamped in a holder that travels in the bar.

In the new method, the toolholder is pinned to a sectional rack gear. This rack is driven by a gearbox that is mounted on the ways behind the pillow bearing that supports the boring bar. Sections can be keyed together quickly and easily, with each section being about three feet long. At the beginning of the cut, enough sections are joined to provide the required travel of the tool. When one full section has fed past the driving pinion, the operator removes this section and places it on the ways. As the rack moves very slowly, this can be done readily without stopping the cut. This procedure continues until the cut is complete. A hand-wheel is provided for running the rack sections back through the bore for the next pass:

Toolholder moves in dovetail in boring bar. Pin through racks prevents sections from pulling out of dovetail

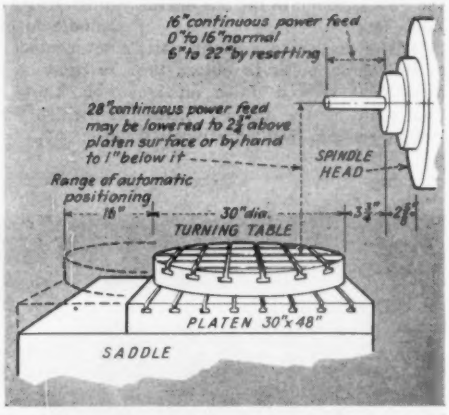
The rack slides in the dovetail provided for the toolholder. A pin at right angles to the rack teeth acts against the sides of the dovetail to prevent the rack from pulling out of the dovetail during the cut. Different feed rates can be obtained through change gears in the gear box.

The boring bar is tapered so as large and as stiff a bar as possible can be used. The dovetail is cut with the bar supported exactly as it is during the boring operation. In this way, the effective sag in the bar is eliminated. Design of the dovetail and toolholder brings the cutting edge exactly on center.

This method greatly enlarges the boring capacity of the existing equipment and the range of work that can be done in the Arsenal shops. When it first was introduced, it eliminated the need for a larger machine and for an investment which, at that time, amounted to around $3000 per ft of lathe length.

HOW TO CUT LARGE MIXED-FLOW IMPELLER VANES

BY ALEXANDER HAMMER*
Formerly Analytical Engineer
De Laval Steam Turbine Co.



1 **Maximum range of the 3-B Jigmil from which largest wheel that may be cut is determined**

When DeLaval was confronted with the problem of cutting impeller vanes too large for the vane-cutting machines, this method was developed to cut them by calculating individual cutter positions for a Jigmil

MIXED-FLOW impeller vanes can be cut on a Model 3-B DeVlieg Jigmil equipped with a rotating table. The method was developed for the first-stage impeller of a 50,000-cfm compressor. To cut the vanes in a vane-cutting machine would require a cutter 28 in. long tapered from 6 to 0.540 in. in dia. Such a large cutter, with the deflection problems involved, made the usual method difficult and expensive, if not impossible.

The length of the passage is three times its average depth. Thus, if the cutter centerline were nearly perpendicular to the wheel axis, it would make a considerable saving in cutter length. This basic idea was known, but it was necessary to develop a method to establish cutter positions and the cutting tables from which the operator is to work.

By establishing the developed views of intersections of a series of cylindrical surfaces with the passageway and using these views to determine the positions of the cutter centerlines in a conveniently selected coordinate system, a method is provided to cut predetermined vanes. This contrasts with the method in a vane-cutting machine which establishes the vanes as a result of cutting.

Basic Principles

The curve of intersection of two cylinders whose axes are in the same plane and perpendicular to each other is a circle. This would be the simplest curve to construct. The solution then would be to have cutter centerlines in radial planes normal to the wheel axis and determine their intersections with cylindrical surfaces between the trough and the top of the profile.

However, vane profile prohibits the use of cylindrical radial cutters. Tapered cutters with radial centerlines introduce new problems because of their varying diameters.

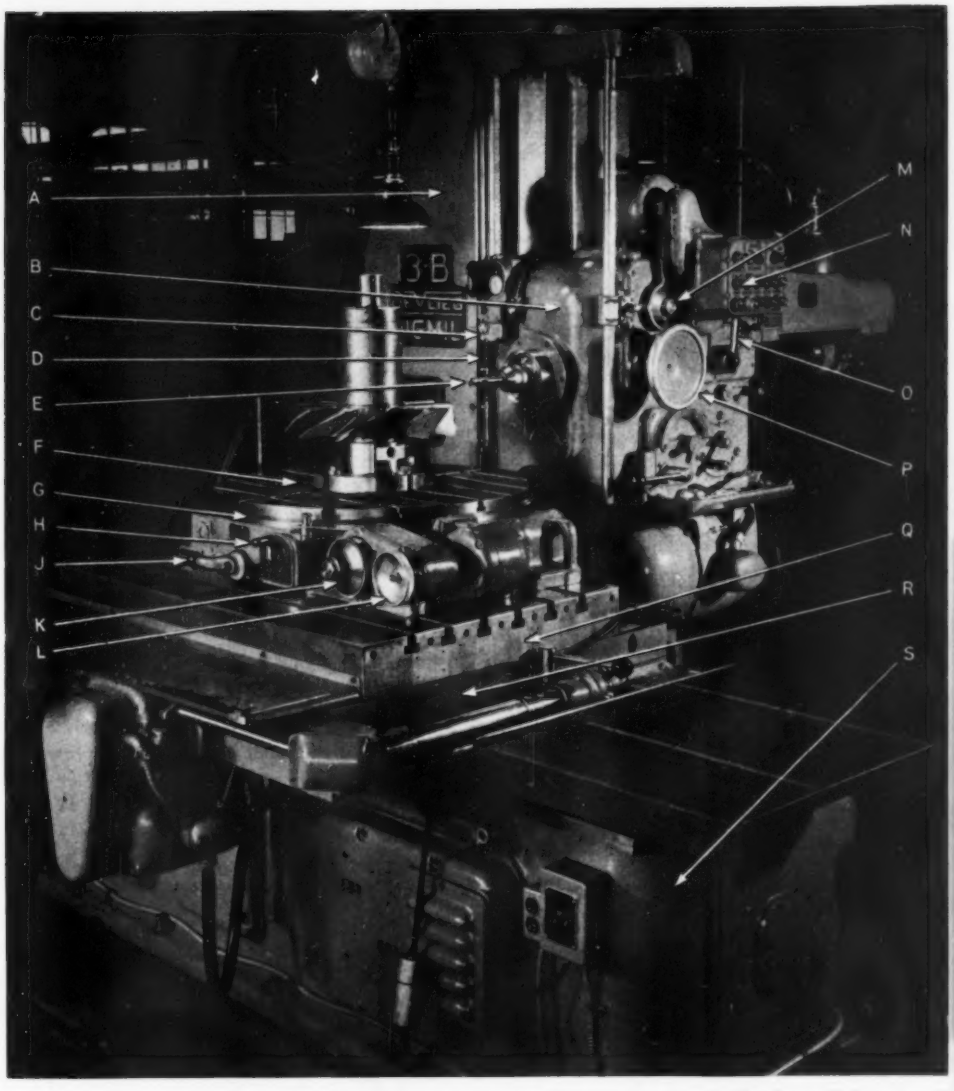
It was found that cylindrical cutters with centerlines slightly inclined towards the radial centerlines of the vane sections form curves of intersection which are ellipses having major axes less than 1% larger than their minor axes. The difference between the ellipse and a circle becomes infinitesimal at the point of contact between cutter and profile.

Because calculations—even slide-rule calculations—are superior in accuracy to results determined graphically, the idea of using developed views of intersections rather than the customary orthogonal projections was adopted. The only function of the graphical layout work is to determine the relative positions between vane and cutter. Individual points are calculated analytically with the required accuracy.

Determining the points of intersection between the centerline of the cutter and at least two cylindrical surfaces through the passageway, selected near the top and bottom of the vane, is sufficient to locate the cutter centerline in a plane perpendicular to the axis of the wheel at a known distance from the face.

Only two points are needed, because the locus of the cutting centers belonging to the same cutter position is a straight line. However, to prove this point, and provide a check on vane thickness, a third cylin-

*Dr. Hammer is now Chief Mechanical Research Engineer, Springfield Armory, Springfield, Mass.



SETUP FOR MACHINING IMPELLER VANES ON A JIGMIL

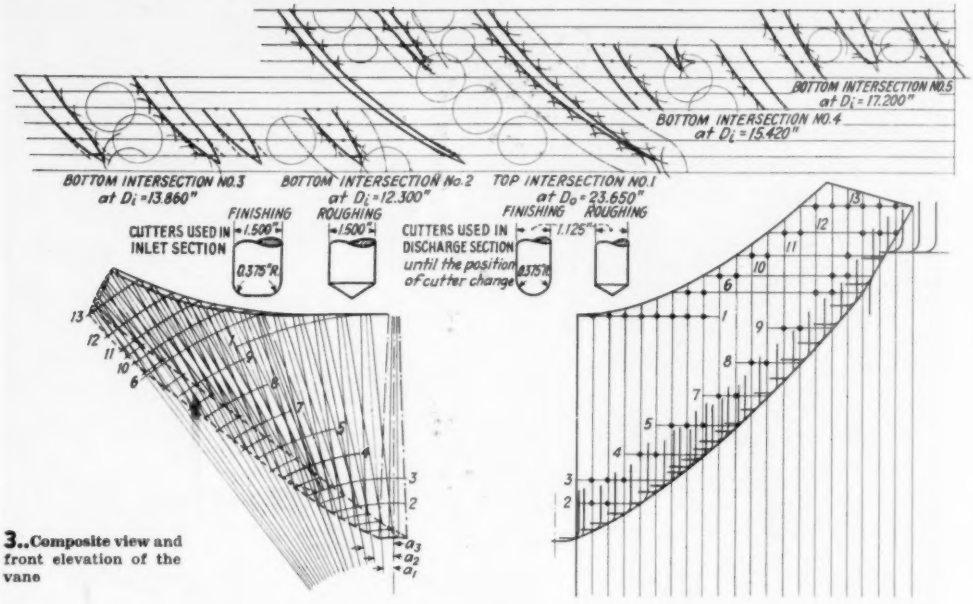
2 **Impeller in place** on turning table mounted on DeVlieg model 3-B Jigmil. There is a fixed relation between the two basic slides in bed *S* and column *A* castings. Saddle *R* has a slide relation with bed *S* that serves horizontal feed of platen *Q*. Cross slide (not visible) parallel to spindle *E* serves movement of platen *Q* for retraction and repositioning.

Turning table *F* is equipped with its own driving unit. Selector switch *H* and locking lever *J* control rapid turning to approach location set by counterclockwise scale *G*. Handwheel *L* will turn table within 2 sec of arc of position determined by dial vernier *K*.

Slide relation between column *A* and spindle head *B* serves vertical spindle feed. A single lever selects and pushbuttons control power feed and rapid traverse.

End measure gages are put in position to change position in horizontal or vertical plane. Pushbutton causes rapid traverse of automatic head-positioning unit *C*, then stop within 0.0001 in. of position determined by stationary end measure gage and/or micrometer *D*. Horizontal end measure gage (not visible) is along saddle *R*. At final location, machine releases screw tension, so lock application will secure head *B* and saddle *R*.

Four-position lever *O* from master switch *N* controls rapid traverse and power feed of spindle *E*. Wheel *P* hand feeds spindle. Micrometer dial *M* facilitates accurate depth control. Pushbuttons control spindle start, stop and jog and provide instantaneous spindle stop



3..Composite view and front elevation of the vane

drical surface is chosen, preferably in the lower half of the vane.

Selecting Intersections

A sufficient number of cylindrical intersections through the passageway, of say a clockwise wheel, are selected at various diameters close to the top and bottom of the vane to determine the cutter positions at ½-in. intervals along the axis of the wheel (Fig. 3). This distance between cutter positions would not produce a smooth vane surface but is close enough to assure accurate interpolation.

Because the bottom of the vane profile is more inclined than the top, more bottom intersections are needed than top ones. Bottom intersections are used as long as they contain full size cutting curves. As soon as the cylindrical surface penetrates the rounded bottom portion of the cutter, a new higher located intersection is selected.

Developed Vane Profile

The composite view and the front elevation of the vane (Fig. 3) contain data required to develop the intersections between the vane and cylindrical surfaces. Turning angles are taken from a curve similar to Fig. 4 and transformed into developed lengths of arcs. They may be measured from any radial plane, not just from the one which goes through the centerline of the vane section in the face plane.

The length of arc of unit angle is constant for any cylindrical intersection of D diameter and equals

$$D\pi/360 = 0.0087266\ D = k \quad \ldots\ldots 1$$

Thus the product $ka = d$ is the developed length of arc between the selected starting position and the intersection of vane centerline with the cylindrical surface shown in Fig 5.

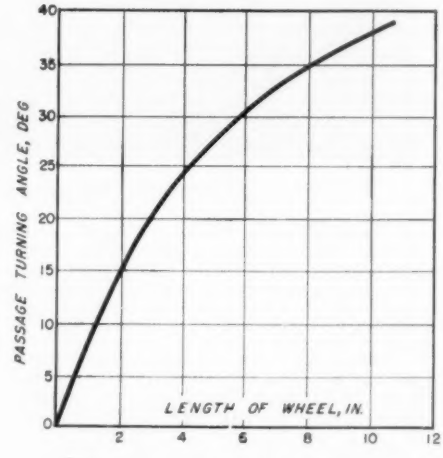
The developed pitch is

$$p = K \times 360/Z$$

where Z is the number of vanes. Duplicating the developed vane section at a distance equaling the pitch results in the developed passageway.

Cutter Positions

Plotting cutter positions at both sides of the same passageway is a safeguard against undercuts, which



4..Passage turning angles of the impeller

do not show up if plotted at the trailing and leading sides of the same vane. The first method is used for checking, the second for calculating. Both are shown in Fig. 6.

Now the distances between the centers of the cutting circles and the corresponding profile centers may be measured. The following subscripts designate the location of any particular distance d:

- o outside or top section
- i inside or bottom section
- T trailing side of vane
- L leading side of vane

When using the same cutter there are no sudden changes in the continuously increasing or decreasing d values which are tabulated for further reference.

Inversely to equation 1, the angle of unit length of arc is

$$\frac{1}{0.0087266D} = \frac{1}{k} = k_1 \quad \text{.....2}$$

Thus, the product $k_1 d$ determines the angular position of the point of intersection of the cutter centerline with the cylindrical surface in reference to the radial vane centerline, Fig. 7. The related equations are:

$$\begin{aligned} k_1 d_{oT} &= x_T \\ k_1 d_{oL} &= x_L \\ k_1' d_{iT} &= y_T \\ k_1' d_{iL} &= y_L \quad \text{.....3} \end{aligned}$$

where k_1' is the constant corresponding to diameter D_i. The angles b, g, and e can also be seen in Fig. 7. They are used in the following equations:

$$\begin{aligned} a + x_T &= b_T \\ a - x_L &= b_L \\ y_T - x_T &= g_T \\ y_L - x_L &= g_L \\ e_T &= \tan^{-1} \frac{r_i \sin g_T}{r_o - r_i \cos g_T} \\ e_L &= \tan^{-1} \frac{r_i \sin g_L}{r_o - r_i \cos g_L} \quad \text{...4} \end{aligned}$$

Thus the position of the centerline of the cutter is defined in a plane parallel to the face at a known distance along the wheel axis, by the polar coordinates of one of its points (r_o and b_T or b_L) and by the angle of deviation from the radial direction (e_T or e_L) at that point.

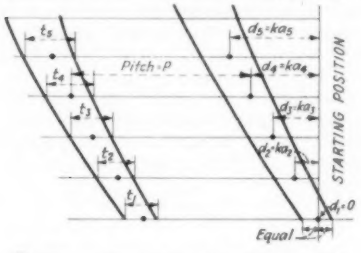
The shortest distance between cutter centerline and wheel axis is expressed by the following equation:

$$\begin{aligned} r_o \sin e_T &= C_T \\ r_o \sin e_L &= C_L \quad \text{.....5} \end{aligned}$$

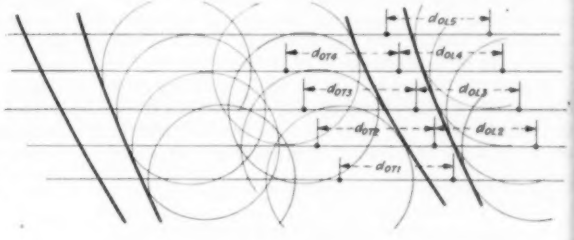
Finally, the distance h along the cutter centerline between its intersection with a cylindrical surface of radius r_b and its point at the shortest distance from the wheel axis is calculated as follows:

$$\begin{aligned} \sqrt{r_b^2 - C_T^2} &= h_T \\ \sqrt{r_b^2 - C_L^2} &= h_L \quad \text{.....6} \end{aligned}$$

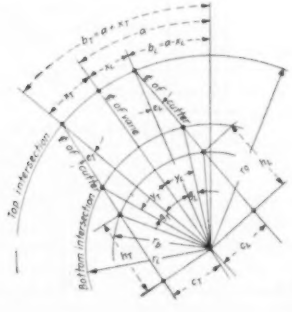
Radius r_b of the cylindrical intersection is determined by the criteria that the bottom profiles of cutter and vane in the composite view are tangential,



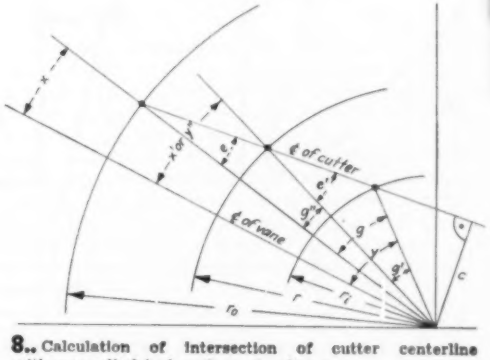
5.. Intersections of vane centerlines with cylindrical surface



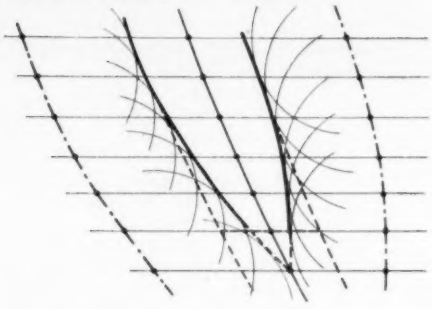
6.. Plotting of cutter positions



7.. Angular position of the point of intersection



8.. Calculation of intersection of cutter centerline with any cylindrical surface of radius r



10.. Decreased section of blade blends into a full size section about 1½ in. from inlet. Two such developed views close to top and bottom establish cutter positions for thinning. Only rounding off of inlet edges is left for hand filing. Note continuity of paths of cutting centers

so no penetration into the wheel takes place beyond the bottom profile of the vane.

Calculating Positions

With these equations, the intersection of a previously determined cutter centerline, Fig. 8, with any other cylindrical surface of radius r can be calculated. If the intersection is considered a top one, then C and y remain unchanged and e′, g′, x′, and d_r′ are determined in that order. However, if the intersection is a bottom one then e and x remain unchanged and g″, y″, and finally d_r″ are the unknowns to be determined.

The angles b and e change inversely (e_T, e_L, b_T) or directly (b_L) with changing radii of cylindrical intersections. However, their sum ($b_L + e_L$) or difference ($b_T - e_T$) at the leading or trailing side of the vane, respectively, remains constant for the same cutter position. The distance C between wheel axis and cutter centerline also remains constant.

In the same way, if a third intersection is considered, the calculations based on any two of the available three data points must ultimately result in the same values for C and the angular sum ($b_L + e_L$) or difference ($b_T - e_T$), respectively.

Calculating Machine Movements

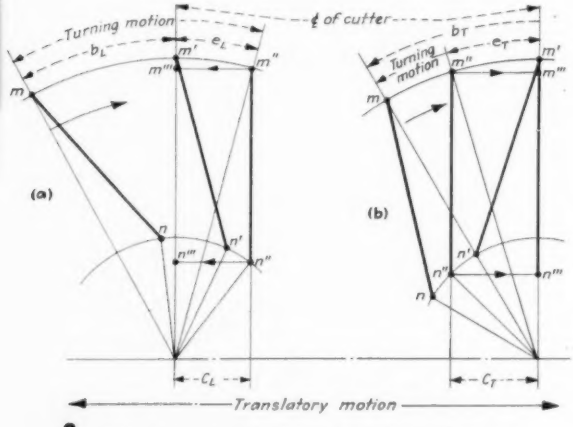
The wheel to be cut is on an arbor fastened to the turning table. In the starting position the wheel axis and the spindle centerline are perpendicular in the same plane. Let us then determine the motions of the work (i.e., the table) that will bring any analytically determined cutter centerline mn into a position m‴ n‴ which is in line with the stationary cutter.

From Fig. 9 we see that turning the table an angle b_L brings the centerline mn into a position m′n′, in which only one of its points, m′, is under the cutter. Turning the table an additional e_L angle brings it to m″n″, parallel to cutter centerline, but offset a distance C_L. Moving the table towards this cutter, the calculated m‴n‴ becomes identical with the actual mn.

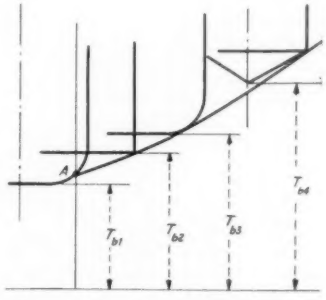
Thus a rotation $b_L + e_L$ and a translation C_L bring the work into cutting position at the leading side of a vane. From Fig. 9 it can be seen that at the trailing side the turning angle is $b_T - e_T$ and the distance C_T is opposite in direction to C_L.

When set up, the end of the cutter is flush with a reference plane that contains the axis of the turning table and is perpendicular to the spindle axis. Thus any h_T or h_L dimension sets a limit to the deepest penetration of the cutter in reference to this plane.

With the centerline of the cutter flush with the face of the work, horizontal table travel and vertical cutter travel provide normal as well as parallel travel to the wheel axis in any chosen increments.



9.. Table movements to bring calculated centerline to cutting position



11.. Cutters at their point of deepest penetration. As long as rounded bottom portion of the cutter is not entirely inside the passage it goes through point *A*

Roughing Cuts

The passage area is always larger than that covered by the cylindrical cutting tools along leading and trailing sides of adjacent vanes. Also, too deep a milling cut increases cutting time and cutter deflection.

This is avoided by roughing out with a drill, leaving about ¼ in. for finishing cuts. Size of the drills is determined by space at the trough of the passageway.

Turning angle of the drill centerline in any plane parallel to the face is

$$x = \frac{a_1 + a_2}{2} = a_1 + \frac{180°}{Z} \text{ if } a_1 \text{ and } a_2 = a_1 + \frac{360°}{Z}$$

determine the position of the radial centerlines of the intersections of adjacent vanes with the same plane.

To avoid "walking," no cut should start with the drill point in space. Each new cut is offset so that adjacent cuts overlap generously at the bottom but only slightly at the top. Allowable deepest penetration is measured from the composite view in Fig. 3.

Cutter Changing

Two, or generally three, different cutter sizes are required to cut the vane. Added care is required to determine cutter positions after changing. The slightest error means a sharp break in the vane surface.

It is best to determine the hypothetical positions of the cutters behind and in front of the position of changing. This provides an extended basis for comparison. Short overlapping near the position of cutter changing eliminates any sudden change along the trough.

Depth Calculations

The cylindrical intersection of radius r_b determines the deepest permissible penetration of the cutter into the passage. The distance along the cutter centerline between its intersection with the surface and its point at the shortest distance from the wheel axis is:

$$h = \sqrt{r_b^2 - C^2}$$

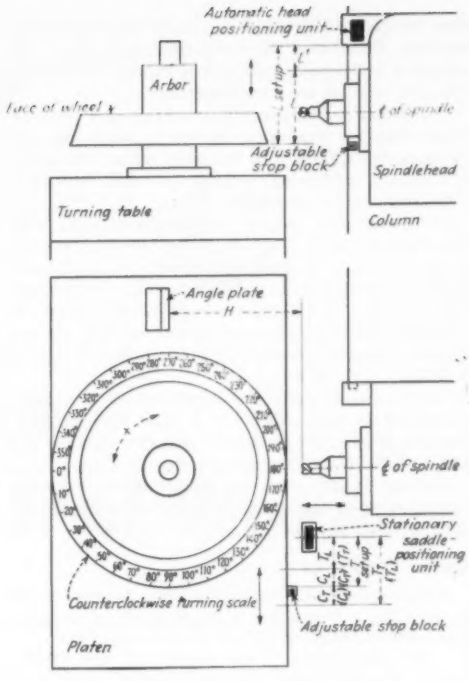
In terms of cutting, h is the distance between the bottom of the cutter and a reference plane which contains the wheel axis and is normal to the spindle axis.

Fig. 11 shows round and flat bottom milling cutters and a roughing drill in one of their deepest positions. Note that depth must be determined by tangential contact with the bottom profile.

Interpolating and Checking

Any position between the ½-in. intervals can be determined by interpolation. On a large diameter a few minutes difference in the angular position of the cutter centerline plus a few thousandths of an inch discrepancy in the translatory movement may result in cutting away the vane at its top.

Accuracy can be checked by plotting the calculated turning angles, translatory movements and depths against movement along the wheel axis. These



12. Setup of the DeVlieg Jigmil

curves are also useful in determining thinning cuts and in changing cutters.

To assure smooth flow, thinning cuts are required at the inlet and at the start of the discharge section, where the number of vanes suddenly increases (Fig. 10).

Curves representing thinning data must blend smoothly into those for full-cut data. In cutter changing, curves for the two cutters should be parallel, or nearly so, when extended above and below the point of changing.

Cutting Tables

Data are presented to the operator in cutting tables which contain, for each operation, the axial movement L, turning angle X, translatory movement T, and depth H data. They also give size and shape of cutter and other setup information.

Vertical end measure gages were 7.500 and 12.000 in. (L_{SETUP}) in inlet and discharge section respectively, so the cutter would leave the passage before the head positioning unit reached the stop block. Axial displacement in the tables is $L = L_{SETUP} - L'$ when L' is the actual axial cutter displacement measured from the face of the wheel (Fig. 12).

Counterclockwise turning scale is set at 0° ($X_{SETUP} = 0$). If the direction of wheel rotation and that of the scale of the turning table are opposite,

then the calculated angles appear in the tables unchanged. Otherwise the complementary angles are compiled in the tables. Angles of identical wheels of opposite rotation are complementary.

Horizontal end measure gages (T_{SETUP}) must be larger than the translatory motion to reach the saddle positioning unit with the adjustable stop block. If T_{SETUP} is 6.000 in., T_T is 6.000 + C_T and T_L is 6.000 − C_L for a clockwise wheel.

For setup with the end of the cutter flush with the angle plate, $H_{SETUP} = 0$. H dimensions are set to the nearest ¼ in. reading on the direct depth scale with the remaining value set on the micrometer dial. Thus H value of 6.808 is recorded as 6¾ +0.058 in.

Roughing cut tables contain the same data, but are simpler. Because roughing cuts are radial, T always is T_{SETUP} = 6.000 in.

Because vane surface is produced by a number of individual cuts, ridges are formed between cuts. Smaller increments produce a smoother surface and reduce hand filing but increase cutting time.

Surface quality of the trough may be improved by removing as much material as possible with properly selected roughing cuts.

Cutter Deflection

Permissible cutter deflection must be considered in selecting cutter size. A quick check of satisfactory cutter deflection is

$$d = .32\ L^{3/4} \qquad 7$$

where d is the cutter diameter and L is the total overhanging length.

If cutter diameter thus determined is too large for the narrow inlet portion of the discharge section, then decrease cutter length or the number of vanes.

Generated Vane

Cutting an average wheel requires reading and transforming into machine movements at least 6000 dimensions. One incorrect reading may cause permanent damage to a vane. Both this problem and the time-consuming hand filing could be eliminated by generating.

Either the present machine with a generating attachment or a redesigned machine would be required. Curves of the calculated data could be made into cam surfaces to guide machine movements.

However, the vane generating cutter moving across the vane (instead of from top to trough) might be subject to excessive deflection. More and larger roughing cuts would be required, and hand filing of the trough would still be necessary.

Conclusion

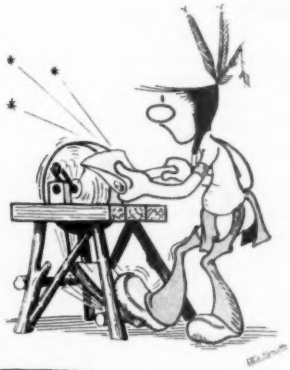
The cutting procedure is being continuously developed. The experience with each impeller has been applied to reduce cutting time and to eliminate as much hand filing as possible. Introducing roughing-cut tables, using the largest possible cutters, and reducing axial increments along the thinned out portions of the vane are among these.

Finally, in cutting 8 wheels and numerous samples, about 60,000 dimensions were set without making even one serious mistake.

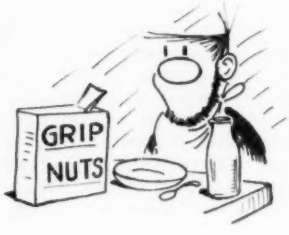
The Grinlings Are Coming—Next Issue

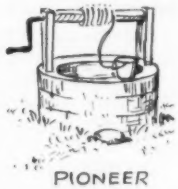
DONALD G. SMITH is an engineer with an amused pen who dares to spoof anybody—witness his conception of the original *American Machinist* at right. His ink satires (below) of three advertisers and our want-ad columns show his pixie approach—and introduce the flat-headed character he calls a "grinling."

Starting May 14, we will bring you Mr. Smith's "Grinetics" each issue, on the first page of our "Backlash" department. He takes familiar engineering and shop terms and gives them a twist that any layman can laugh at. We expect shortly to see the series posted on shop bulletin boards the country over — because shop men will laugh at them too. Follow the series—and give us your opinion.

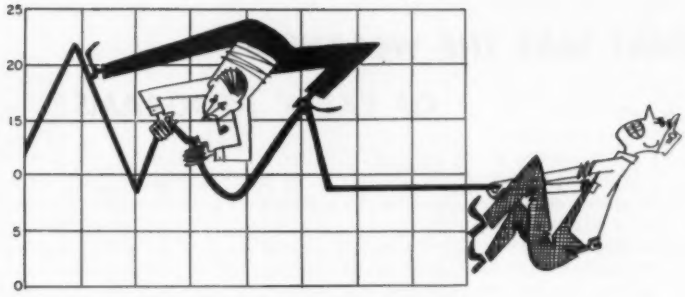


SEVERANCE TOOLS





PIONEER PUMP



How To Make Quality Control Work

Quality control at Thompson Products is an important method of improving quality, reducing costs, and cementing producer-customer relations. Begun early in 1943, Thompson's program has grown from a few scattered applications until it now covers all important operations. Accompanying this expansion has been a steady decrease in the cost of scrap and rework, with reductions in some divisions running as high as 65% of previous defective-work ratios. Furthermore, as quality improved, inspection costs dropped. Thousands of inspection manhours have been saved, and only four people have been added to the organization for the specific purposes of quality control. Today, because of statistical methods, Thompson Products achieves high standards of quality with much greater relative ease than at any time in the company's history.

Yet early attempts at statistical control were only partially successful. Thompson's first program limped along during the war years and finally was abandoned. The second, begun in the immediate post-war period, lasted only nine months. It was not until the third attempt that a really effective program got under way.

Why did the first two programs fail? What had to be done before efficient quality control could be introduced? How is the program operated and administered today? The answers to these questions are found in this report describing Thompson's experiences in setting up and developing a program that has become one of industry's leading examples of the efficient and economical application of statistical techniques to the control of quality in production.

Material appearing in the following pages was prepared by Dr. J. V. Strela, staff statistician, Thompson Products, Inc., and was drawn from the three divisions in the TAPCO plant. Although quality control currently is applied in other divisions, it was in the TAPCO plant that much of the experience that guided the development of the present program was gained. It is hoped that the story of Thompson's experiences will be helpful both to those who plan to install quality control and to those who may not be getting the most out of their present program.

A SPECIAL American Machinist REPORT TO THE METALWORKING INDUSTRIES

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WHAT WAS THE WEAKNESS OF EARLY PROGRAMS?

ON January 2 of this year, Thompson Products celebrated its 50th Anniversary. Its products, automotive and aircraft parts, require the highest attainable dimensional quality. In all plants, quality characteristics are measured to a few thousandths, tenths, and, in some cases, even to a few millionths of an inch. Consequently, quality always has been paramount with the organization and it has always been interested in any method likely to help in achieving desired quality standards.

As statistical methods of control not only improve quality but also reduce scrap and repair, decrease inspection costs, and improve customer-producer relations, men in the Thompson organization were interested in the technique as early as 1943. At that time, the Chief Engineer of the TAPCO Plant and the Quality Managers of the TAPCO Plant and the Special Products Division attended quality-control courses given under the auspices of the War Production Board. After completing the course, the Chief Engineer reported the benefits of the statistical method to a meeting of factory personnel, to which the Head of the Statistical Dept. of the Wage and Salary Planning Department also was invited. The Chief Engineer then trained a young process engineer who was asked to introduce the program in the factory.

Defects in the First Program

The program thus initiated was sporadic, perhaps chiefly because the engineer in charge could devote only a small portion of his time to it. It was administered inefficiently, and used no printed forms. Control charts were plotted on millimeter paper which made plotting tedious, clumsy, and inaccurate. Data were posted on separate forms and were easily lost or confused. Much time was consumed by ruling of charts and scales, and by copying constantly repeated information that should have been printed on the forms. **The program was not backed with any enthusiasm; perhaps chiefly because it was more or less imposed upon the line organization without sufficient explanation of its purpose.** With V-J Day, when practically all Army and Navy contracts were cancelled, the program disappeared.

Yet Benefits Were Obtained

Despite the fact that the program was hardly a program in the true sense of the word, considerable benefits resulted from it. To illustrate, a costly aircraft valve with a special alloy tip to be welded after about eight dollars of labor had already been added, was causing considerable trouble. Scrap ran high, despite fairly liberal tolerances. Thus the cost of 100% inspection had to be added to the already mounting cost of production, scrap, and rework. As control charts for averages and ranges were applied to the operation, probable assignable causes of excessive variability were reasoned out and gradually eliminated until the process was brought into such an excellent state of statistical control that the former 100% inspection was discarded and considerable reduction of tolerances became feasible. The job then was performed on less valuable equipment capable of meeting the required tolerance if control was maintained.

In another case, the cubic content of a hollow aircraft valve caused considerable difficulty. Sodium is sealed into the cavity of the valve to act as a coolant when the valve is exposed to tremendous heat in operation and its amount has to be proportioned to the volume of the cavity. To obtain consistent results, control charts for averages and ranges were applied to the operation for milling the cavity in the valve. Data were obtained by filling the cavity with water from an overhead container and reading the cubic content on a calibrated scale. This information provided a quick check-up on the process and the operation was brought into such good control that eventually volume - charting was completely eliminated.

Control charts on Rockwell hardness afforded valuable clues to improvement of several processes. In another case, the customer who undoubtedly understood the significance of a control chart, was willing to accept a simple part made for him without any inspection at Thompson, if control charts for averages and ranges showing the history of the parts was furnished him and if the charts gave evidence of statistical control. For a long time, the part was thus produced and shipped without any final inspection. **Thus, although the total benefits were far below what was to be realized later, good results were obtained even from Thompson's first limited experiences with statistical quality control.**

Start of the Second Program

A new phase began after the war. At that time, Thompson Products went through considerable reorganization and the present divisional breakdown was established. The Staff Industrial Engineering Department was created to promote good methods in all activities of the individual divisions and statistics was recognized as a staff function. At the same time, in the Valve Division, the position of Quality Control Engineer was officially created and an outside man was hired to install the program. In the shop he was to be assisted by three inspectors who were to administer control charts, one for each shift. The pro-

TRAINING LAYS GROUNDWORK FOR EFFECTIVE APPLICATION

Quality-control courses stress basic knowledge of statistical methods, then develop techniques for controlling production operations. Practically all levels of factory supervision have taken courses

gram was under the same Quality Manager as during the war. Nine months of the program under this setup may be characterized thus:

It was still sporadic and limited in scope. It was inefficiently administered, and the same clumsy method of charting was used. Data were posted on separate sheets and much time was spent in unproductive paper work. Considering that four people now were on the job and that the program was hardly greater than during the war, the program showed regression rather than progress. There was very little genuine cooperation between the Quality Control Department and the line organization, although no enmity existed between the two. After nine months, the Quality Control Engineer left the organization. The program lingered a few more weeks under the man who administered it during the war, and, then, at the suggestion of the staff statistician, was abandoned.

What Was Wrong? — And the Cure

In my opinion, the inefficiency of the program resulted from sudden installation without any systematic laying of foundations on which to build the program. **As no training in the rudiments of the technique was given to the line organization, the method was considered a nuisance rather than a helpful guide to performing a better job.**

Today, the situation is entirely different. From the Chief Inspector down, practically every supervisor and floor inspector understands the technique and appreciates its usefulness. At the TAPCO plant, Inspection looks upon statistical methods as the most helpful tool with which they have been supplied in many years. Their understanding and complete acceptance of the technique is one of the major reasons for the effectiveness of the program.

This appreciation, however, is not confined to Inspection alone. Operators have been told how to read charts and find their jobs easier with organized data to guide them. Supervisors, and in many cases management officials, voluntarily have taken in-plant training to familiarize themselves with the statistical method. The result is an organization that is fully aware of the benefits of statistical quality control and is solidly behind the program.

HOW DO WE TRAIN FOR QUALITY CONTROL?

ALTHOUGH TAPCO's line organization now is sold on the benefits of statistical quality control, this attitude did not develop quickly or automatically. It was built up gradually through a series of training courses that were developed by the staff statistician only after he had given serious consideration to the defects of the first two programs.

As he had attended a Government-sponsored course in quality control during the war, the staff statistician was aware of the unavoidable weaknesses of those courses, as well as of the lack of professional background of most of the students. He felt that **most trainees failed to get full benefit from the courses because they were given hurriedly and without sufficient emphasis on the logical basis underlying the technique.** Consequently, he determined to design a training program which would not sacrifice statistical method, yet which would be so documented by examples from everyday experience that eventually the technique would appear as a logical solution for many problems.

Stresses Fundamentals

This course breaks the ideas of the technique into segments, then complements them with related segments until the whole structure is built. Furthermore, quality control, as such, is kept entirely out of the picture until the foundation is laid. Then, the story of quality control is quickly developed and tested by considerable data assembled either in the classroom or from the shop. In this manner, the theory of large samples symbolized by the law of normal distribution is explained and from this the dimensional control of quality, based on the theory of small samples, is developed. In a similar manner, the theory of acceptance sampling, the understanding of which usually presents great difficulty even to college students, also is developed by a logical, as well as a statistical analysis of familiar data. Thus, eventually, all phases of the technique are built on the basis of a unifying philosophy of the subject.

Charts and tables are used for

explaining every phase of the technique and for practical exercises in processing, analyzing, and interpreting numerical values from many fields of mechanics, economics, biology, and other phenomena. The intent is to show that the same laws of chance which underly the technique of quality control apply to most variable characteristics. By showing the existence of these laws of chance all around us, the course brings about ready acceptance and understanding of the "new technique" through its association with generally known facts.

Course Leads to Better Methods

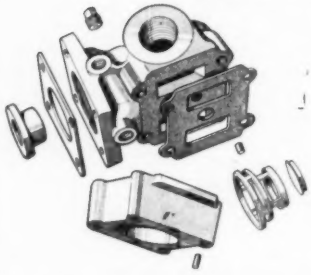
Actually, this course does far more than just familiarize the student with charting practice and other relatively simple quality-control techniques. It provides a good grounding in the statistical method of which quality control is simply one form of application. **At Thompson Products, statistical method is a means to methods improvement regardless of the field of activity in which it is applied.** As a result of this course, we have succeeded not only in furthering understanding of quality control but also in stimulating several other worthwhile improvements through application of the statistical method in entirely different fields. For example, J. S. Petro, chief of standards on the staff industrial engineering department, applied the new tool in establishing ratio delay standards through random observation.[1] This is only one of several applications made through the individual initiative of graduates of this course.

[1] *Using Ratio Delay Studies To Set Allowances—J. S. Petro, Factory, Oct., 1948.*

Training Shows Results

At the time the course was developed, however, there was little understanding of the statistical method in the organization in general. Consequently, within a few days after the staff statistician announced his course in statistical control, a class of 15 was organized. Most of these people were from the Accessories Division, including division industrial engineer, factory manager, chief engineer, quality manager, and several standards engineers, time study supervisors, and methods engineers. All were younger people with fine professional and practical experience and soon began to apply the training in their work.

QUALITY CONTROL CUTS SCRAP IN THE ACCESSORIES DIVISION



IMMEDIATELY after the course in quality control, acceptance sampling was installed in the Accessories Division. Many parts in this Division are purchased outside and, as these parts go into important assemblies, most of them are sampled for lot tolerance fraction defective, rather than the customary average outgoing quality limit, although such sampling also is used. Dodge-Romig Sampling Inspection Tables are employed as they provide the minimum amount of inspection, especially if the process average of the quality received or produced is known. Vendors are rated and quarterly reports on quality of material received from them is issued for the benefit of the division, as well as for top management. Although this program began at once, it was several months before a formal program for dimensional control of quality was started in the Accessories Division.

Machine Capability Studies

Meanwhile, statistical techniques were applied on specific problems by several graduates of the course. One industrial engineer employed the control-chart method in studying machine capabilities. As he became convinced of the reliability of the new tool in revealing the state of machines and the consistency of operators' skill, he began showing the results to his superiors. These efforts stimulated considerable interest, as did the work of several other graduates.

During this period, the Accessories Division was producing hydraulic couplings, a complicated part machined principally on turret lathes. These machines were considered inadequate for the job and extensive replacements were considered unavoidable. However, when the engineer who experimented with statistical control and the staff statistician surveyed the control charts from many operations on these lathes, the machines were shown capable of meeting the tolerances required. As a result, an expenditure of over $40,000 was avoided. Furthermore, the study presented a rational and economical basis for a new machine-maintenance policy in that division.

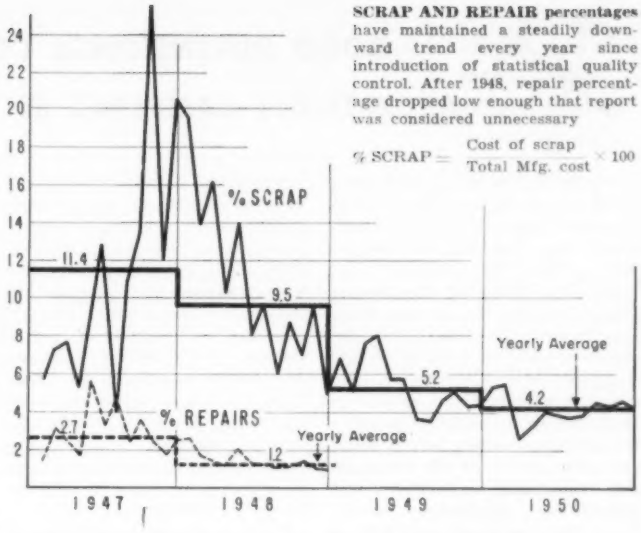
Control of Complex Parts

At the end of November, 1947, the division decided to install dimensional control of quality in the whole hydraulic coupling department and on many operations in several other lines. A Quality Control Technician was appointed to administer the charts in the shop and to act as the Quality Engineer's assistant. As a result, the percentage of scrap and rework continued to decline, as illustrated, based on data from the Accounting Department. The reason for giving scrap and repair information in this manner is that the division produces such highly complicated parts that reporting percentages of scrap on the basis of pieces rather than on the basis of monetary value is not feasible. For example, vane wheels are machined from solid aluminum

forgings and often have more than a thousand chracteristics. Likewise, many other parts have an exceptionally large number of characteristics. Consequently, every possible precaution is taken to avoid scrap, and quality is measured by the average number of defects per unit rather than by the customary average fraction defective of the pieces produced. Needless to say, quality control applied to such highly complicated parts must employ techniques much more advanced than the customary control-chart technique. There is close cooperation between Process Engineers and the Staff Statistician in this department.

Control Is Not Costly

Soon after introduction of the program, considerable interest in supervisory training in quality control was aroused, and the staff statistician was requested to design a short course for the purpose. The course soon was repeated with another group of supervisors and eventually the engineer in charge of the program was given a chance to teach his own men the rudiments of the technique. Thus, practically the whole supervisory force eventually acquired elementary training in quality control and chart making then was entrusted to them. At the same time, they were given authority to stop processes if charts indicated lack of statistical control. In this manner, the program grew without additional expense for its administration.



SCRAP AND REPAIR percentages have maintained a steadily downward trend every year since introduction of statistical quality control. After 1948, repair percentage dropped low enough that report was considered unnecessary

$$\%\ \text{SCRAP} = \frac{\text{Cost of scrap}}{\text{Total Mfg. cost}} \times 100$$

Despite the fact that in this division conditions for the successful operation of a quality control program are less ideal than in the Valve Division, in which long runs characterize the production of simpler products, in the Accessories Division the program has never suffered a relapse. Actually, such advanced techniques as tests of significance, analysis of variances, differences of means, correlations, and other methods are finding considerable application in the division on jobs where they are useful.

What Is the Place of Quality Control in the Organization?

Thompson's quality control setup, as found in the Valve and Jet Divisions, is best explained by considering both its operating and management phases.

OPERATIONAL LEVEL:

At TAPCO, the Quality Control Engineer reports to the Division Industrial Engineer and is on a level with other industrial engineers. As quality control is viewed as a methods-improvement technique rather than as a single application of statistical method, this is both a logical and practical arrangement. Nevertheless, because of the close relation of the Inspection Department to quality assurance and maintenance, Inspection is the logical department for execution of the plans laid out by the Quality Control Department. Thus, the chief duties of the Quality Control Engineer are to conduct statistical investigations on the basis of which proper sampling layouts, suitable control-chart techniques, etc., are determined. These then are introduced to inspection personnel for execution. As inspection supervision is trained in the basic technique of quality control and also has authority to take corrective action at its own discretion, the Quality Control Department is limited to very few people, although its services are of inestimable value and reach practically all areas of quality production and inspection effort. In this sense, TAPCO'S setup is exceptional. To a great extent, this is possible because quality control knowledge is disseminated to practically all levels of supervision and inspection.

MANAGEMENT and STAFF LEVEL:

The Division Industrial Engineer reports to the General Manager of TAPCO but receives functional direction from the Chief Industrial Engineer who reports to the General Manager of the Corporation. The Staff Statistician, under the Chief Industrial Engineer, develops sound statistical practices within the divisions, including methods developed or applied by the Quality Control Department. Practically all training is done by the Staff Statistician. Integration of effort on both division and staff level has given the Thompson program a unified purpose that to considerable degree is believed responsible for the efficient operation of the program.

GOOD DIMENSIONAL CONTROL PERMITS ACCEPTANCE SAMPLING IN VALVE DIVISION

THE success of quality control in the Accessories Division renewed interest in the other divisions. Two more intensive courses were given, with practically the entire Staff Industrial Engineering Dept. attending the second. Then, late in 1947, the Chief Industrial Engineer gave six lectures on the principles of quality control and demonstrated their applicability to shop operations. **Limited practice in chart construction helped overcome the belief that the technique was something mysterious and difficult to administer.** Shortly thereafter, the chief inspector of the Valve Division asked the staff statistician to train two of his inspection foremen in the basic theory of statistical control of dimensional quality. This decision actually marked the beginning of real quality control in the Valve Division.

We Can Forge to Closer Limits

The foremen selected for training appreciated their opportunity and were eager to put the new method to test. Because of their thorough familiarity with both machining and forging operations, they began to reason out the likely assignable cause of many unsatisfactory conditions in their areas. **They realized that unless machining operations are preceded by statistically controlled forging operations, no amount of control charting will achieve economic control of the machining operations.** Thus the frontal attack began in the Forge Department, but soon extended even to the preceding cutoff operations, as the quality of forging and extrusion largely depends on uniformity in cutoff.

In the Forge Dept., even the first charts showed relatively good control of ranges, although averages were extremely erratic. To be sure, the excessive variability as revealed by these averages was a familiar story. However, the relative uniformity of ranges was quite surprising, as most blame for the excessive variability of the process up to this time was attributed to the poor conditions of the presses. The charts indicated that assignable causes of excessive variability were either lack of heat control of dies and slugs or too frequent and unjustified human interference with the process. Where ranges showed lack of control, need of major repairs of the presses was given serious consideration. Action based upon this information gradually improved the processes until tolerances of ±0.005 in. were successfully met on most presses which previously were producing variability three times that great.

Machining Is Improved

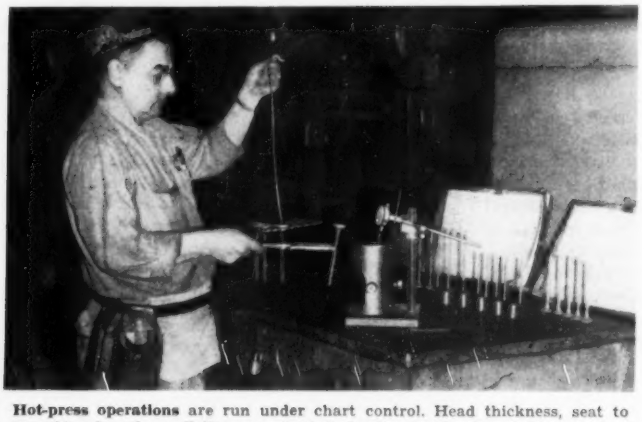
As the new method required correct reading of dimensional values, old "go" and "no-go" gages had to be replaced by special barrel gages, the design for which was suggested to the factory engineer by the chief inspector and his two foremen. As a result, pieces that reached the machining lines were much more uniform in size and the machined chracteristics themselves were brought into good control. As most of these operations are performed on automatic machines, out-of-control ranges again indicated machines that needed attention. Eventually, through good and continued control, several intermediate operations were completely eliminated and many 100% inspections were replaced by small sample inspections.

Floor Inspectors Run the Charts

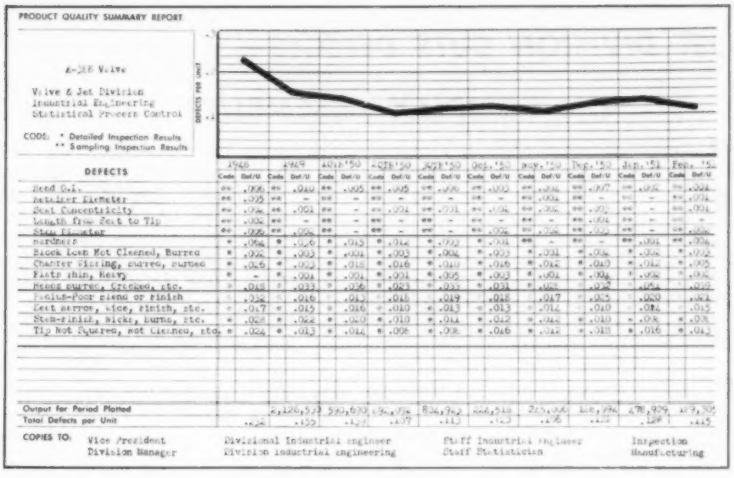
To insure timely corrective action on uncontrolled processes, floor inspectors were instructed in the technique and in plotting the charts. They had the authority to stop uncontrolled processes and take steps to insure corrective action. Practically all this training was done by the two inspection foremen themselves.

However, as the program continued to grow, it was decided to appoint a Quality Control Technician. Later, with continued growth, a Quality Control Engineer also was hired to coordinate the program. This man had a good professional background and experience,

CHARTS MEAN GREATER ACCURACY IN FORGING



Hot-press operations are run under chart control. Head thickness, seat to top-of-head, and parallelism are charted simultaneously. Charts are analyzed in quality control office, then are filed for future reference



PRODUCT QUALITY SUMMARY REPORT

A-328 Valve

Valve & Jet Division
Industrial Engineering
Statistical Process Control

CODE: * Detailed Inspection Results
** Sampling Inspection Results

DEFECTS PER UNIT

DEFECTS	1948 Code	1948 Def/U	1949 Code	1949 Def/U	4Q'48-1Q'50 Code	4Q'48-1Q'50 Def/U	2Q'49-1Q'50 Code	2Q'49-1Q'50 Def/U	3Q'49-1Q'50 Code	3Q'49-1Q'50 Def/U	Nov.'49 Code	Nov.'49 Def/U	Dec.'49 Code	Dec.'49 Def/U	Jan.'50 Code	Jan.'50 Def/U	Feb.'50 Code	Feb.'50 Def/U
Head Out.	**	.006	**	.040	**	.005	**	.005	**	.006	**	.005	**	.006	**	.007	**	.006	**	.004
Retainer Diameter	**	.005	**	-	**	-	**	-	**	-	**	-	**	.001	**	-	**	-	**	.001
Seat Concentricity	**	.004	**	.001	**	-	**	.001	**	.001	**	.001	**	.001	**	.001	**	-	**	.001
Length from Seat to Tip	**	.001	**	-	**	-	**	-	**	-	**	-	**	.001	**	-	**	-	**	-
Stem Diameter	**	.006	**	.006	**	-	**	-	**	-	**	.006	**	.006	**	.006	**	-	**	.006
Hardness	*	.004	*	.026	*	.015	*	.014	*	.012	*	.011	**	-	**	-	**	.001	**	.006
Stock Left Not Cleaned, Burred	*	.024	*	.033	*	.021	*	.032	*	.006	*	.033	*	.031	*	.026	*	.024	*	.032
Chamfer Missing, Burred, Burned	*	.049	*	.052	*	.018	*	.046	*	.040	*	.046	*	.046	*	.047	*	.044	*	.045
Faulty Shim, Recap	*	-	*	.004	*	.004	*	.004	*	.005	*	.003	*	.001	*	.004	*	.004	*	.004
Nicked, Burred, Cracked, etc.	*	.018	*	.032	*	.026	*	.023	*	.023	*	.031	*	.021	*	.028	*	.024	*	.022
Finish-Poor plate or finish	*	.024	*	.016	*	.012	*	.015	*	.019	*	.018	*	.017	*	.015	*	.009	*	.014
Seat Narrow, Wide, Finish, etc.	*	.017	*	.015	*	.016	*	.010	*	.013	*	.013	*	.016	*	.010	*	.014	*	.015
Stem-Pitted, Nicked, Burred, etc.	*	.020	*	.042	*	.020	*	.010	*	.014	*	.012	*	.016	*	.010	*	.014	*	.018
Tip Not Figured, Not Lapped, etc.	*	.004	*	.043	*	.014	*	.008	*	.008	*	.016	*	.012	*	.013	*	.010	*	.012
Output for Period Plotted			2,220,522		570,670		836,942		444,540		215,166		140,994		478,924		419,504	
Total Defects per Unit		.126		.459		.219		.177		.113		.143		.126		.110		.149		.145

COPIES TO: Vice President, Division Manager; Divisional Industrial Engineer, Division Industrial Engineering; Staff Industrial Engineer, Staff Statistician; Inspection Manufacturing

REPORT TO MANAGEMENT SHOWS QUALITY PERFORMANCE ON VALVES

Monthly quality report keeps line supervision and top management posted on quality trends. Same form is used by girls in quality-control office to record daily figures from which monthly figures are computed. Original figures come from daily report of line inspectors

and fortunately a common professional viewpoint on quality control is shared by the men who administer it at Thompson.

Line Inspection by Sampling

When the new quality control engineer began work about two years ago, most processes in the Valve Division were in such good control that acceptance sampling in practically all lines was feasible. Therefore, the inspection foremen and the quality technician were trained in this phase of the technique. This second phase of the program had been intentionally postponed until good control had been established on dimensional characteristics and the men had acquired considerable practice with control-chart methods. As levels of quality were known by this time, proper sampling layouts for all characteristics were prepared in the quality-control office and were subsequently brought into the shop where inspectors were instructed in their use. Dodge-Romig Double Sampling Tables were chosen because of their special economy while guaranteeing desired levels of quality protection. On the basis of this sampling and the 100% visual inspection, a combined Monthly Quality Report then was inaugurated to keep line supervision and top management posted on quality trends.

At present, these reports are issued for thirty-two valve lines and for thirty-six lines in the Jet Division. Practically all compilation of data is done by two girls in the quality-control office. **The two girls and the quality-control engineer and technician are the only people specifically engaged for administration of the program.**

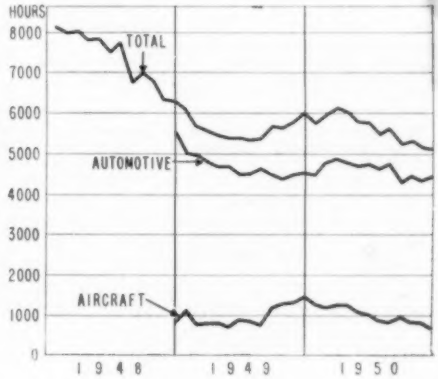
Quality is measured in the average number of defects per unit rather than in the customary average fraction defective. It is a very small fractional value, caused chiefly by non-conforming visual attributes rather than by dimensional substandard quality. That fact is an indirect confirmation of the excellent control over measureable characteristics that has been accomplished with the aid of control charts in this division.

Inspection Hours Per Unit Drop

During the past three years, inspection hours per unit of product have dropped considerably. The leveling of the trend is caused by a new manufacturing process which as yet has not been fully perfected and which, in September 1949, caused the addition of four inspectors to the aircraft lines. **As about six million valves are produced monthly, savings suggested by the decreasing trend are considerable, while those effected through material saving, better utilization of tools and machines, reduced scrap, and improved customer relations are much more significant.**

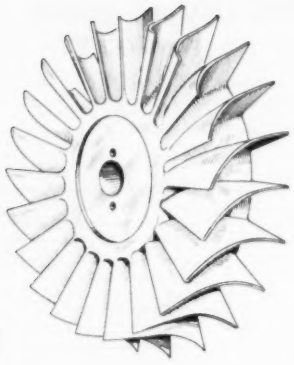
HOURS PER MILLION VALVES INSPECTED

Trend of inspection manhours is steadily downward since statistical techniques have permitted dimensional control and thus acceptance sampling on many operations. Chief Inspector reports figures to management monthly



JET DIVISION CUTS DEFECTS

ON COMPLEX ASSEMBLIES



Compressor inducer is one of many aircraft items that must be produced to tight quality specifications

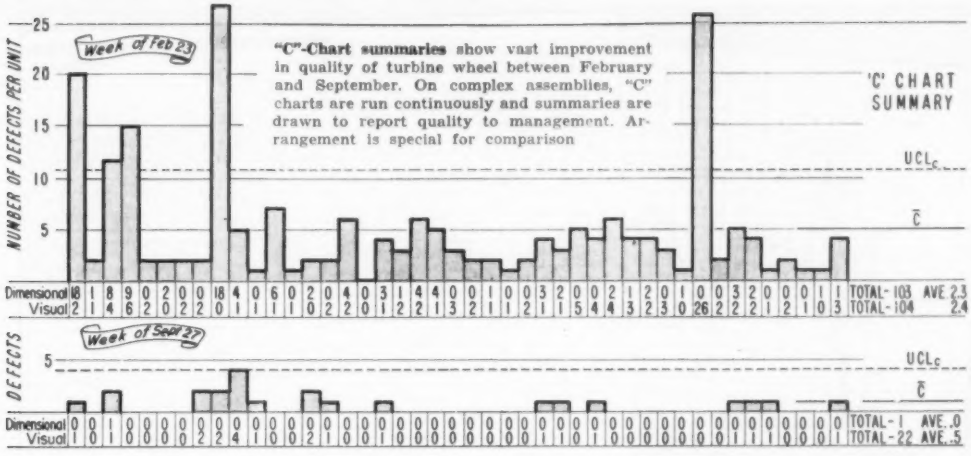
As THE WELL established program in the Valve Division did not require the attention of the new quality-control engineer, he could devote his energy to the development of the program in the Jet Division where only a few people from higher supervisory ranks had attended courses given previously by the staff statistician. A short course in the technique was given to forty supervisors and floor inspectors who then were charged with the same responsibility and authority as those in the Accesories and Valve Divisions.

Forging, machining, polishing, and assembling jet blades of many shapes and sizes presents problems considerably different from the forging and machining of automotive and aircraft valves. The physical aspect of the program in this division therefore is considerably different from that in the Valve Division, although it is administered in the same way. Charts for averages and ranges are not employed as extensively as in the other divisions, but acceptance sampling is applied to a considerable extent. As highly complex assemblies for various jet engines are assembled from parts produced at Thompson, "c charts" find extensive application in this division.

These Are the Techniques That Thompson Employs

	TECHNIQUE	APPLICATION	PURPOSE
1	$\bar{X}$, R Charts with standard control limits.	Quality-control studies of processes for which no statistical standard of past performance is available: (Forging, Machining, Grinding, and Heat-treating operations).	To determine natural limits of variability due to chance causes, and their relation to blueprint tolerances.
2	$\bar{X}$, R Charts with modified control limits.	At the operations by inspection personnel (Machining and heat-treating operations)	To utilize full tolerance spread and maintain control.
3	$\bar{X}$, R Charts with limits based on "selected" standard deviation.	Well-controlled processes with either wide tolerances or when no time is left to establish a reliable standard based on process average range.	To provide guidance to correct setup, and to secure an approximate preliminary audit of quality.
4	"C" Charts (number of defects per unit).	Machining and welding of assemblies: (Jet-engine Assemblies).	To minimize the number of defects reaching final 100% inspection and the customer.
5	"p" Charts (fraction defective).	Machining operations for "go—no-go" mechanical defects: (example: hole diameter may have a burr after reaming).	To utilize floor inspection effort to improve and maintain quality.
6	"np" Charts (number of defective units).	Visual defects: (hand polishing turbine buckets).	To bring operators to the same level of skill, and to improve and maintain quality.
7	Single sampling using Dodge - Romig Sampling Tables: (a) A.O.Q.L. (b) Lot Tolerance	Inspection of piece parts: (a) from vendors. (b) between TAPCO dept. (c) in TAPCO shipping inspection dept.	To avoid cumbersome selection of samples (A.O.Q.L. in shop; lot tolerance in receiving-inspection).
8	Double sampling using Dodge - Romig Sampling Tables.	Same as above.	To effect economies inherent in the minimum amount of inspection, and to minimize inspection effort.
9	Sampling Plan for Continuous Production (Harold F. Dodge), A.O.Q.L. Concept.	Inspection of parts in process.	To bring final inspection as close as practicable to the operations. To utilize the adaptability of the method to changing inspection procedures.

TURBINE-WHEEL REPORTS, COMPARING TWO WEEKS


NUMBER OF DEFECTS PER UNIT
Week of Feb 23
"C"-Chart summaries show vast improvement in quality of turbine wheel between February and September. On complex assemblies, "C" charts are run continuously and summaries are drawn to report quality to management. Arrangement is special for comparison
'C' CHART SUMMARY
UCLc
C̄
Dimensional
Visual
TOTAL- 103 AVE 2.3
TOTAL- 104 2.4
DEFECTS
Week of Sept 27
UCLc
C̄
Dimensional
Visual
TOTAL - 1 AVE. .0
TOTAL - 22 AVE. .5

WELL-PLANNED FORMS SAVE TIME

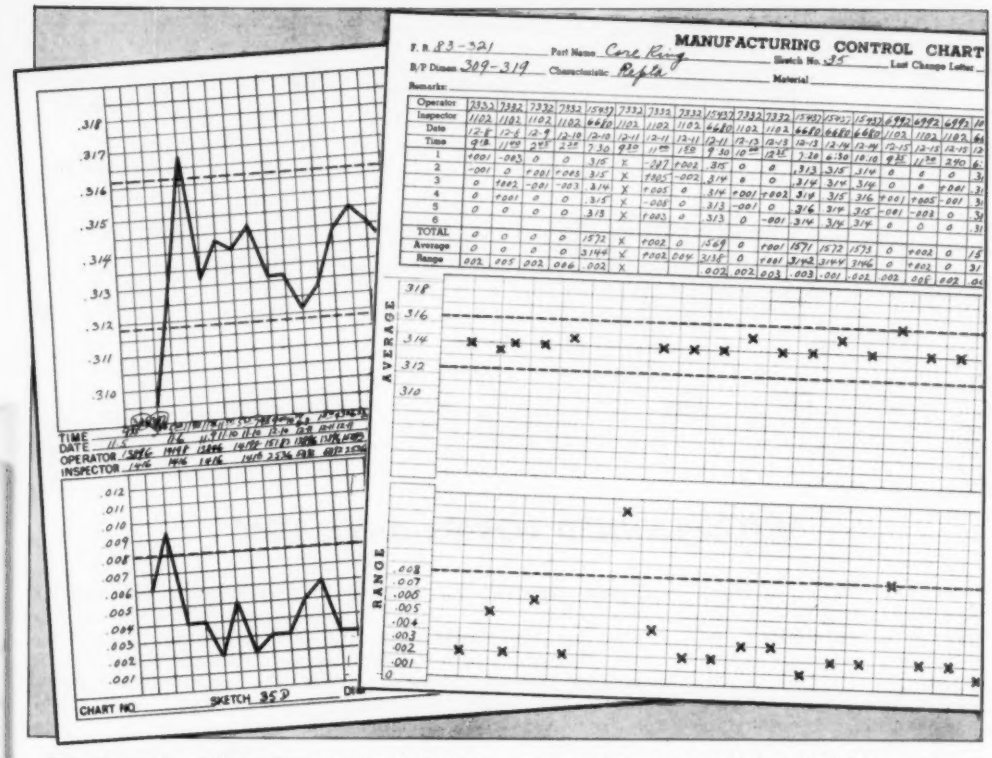
CONSIDERABLE time and money can be saved through well-planned forms, economicaly used. This fact seldom is fully realized and many plants add needless expense to quality-control activities by adopting a ready-made form without considering its suitability to their needs. At Thompson Products, we have found that it pays to design a quality-control form for the job it has to do and we have several types in use throughout the divisions.

In the Accessories Division the first form for averages and ranges was a blueprint form, which soon was superseded by an improved printed form. This, in turn, was replaced with the present printed form shown on next page. Wide spacings are considered necessary because, in this division, most dimensions are read with micrometers and inspectors prefer entering the whole numeral rather than as many thousandths or tenths from some dimension chosen as the zero reference. The present form accommodates 31 samples of as many as 6 values. This is convenient in charting a 6-spindle automatic, as it permits a sample containing one piece from each spindle. Thus, a true indication of process variability can be obtained readily.

When the Valve Division reopened its program, it first drew mimeographed forms of its own design, but then began borrowing from the Accessories Division. However, when the staff statistician was consulted on the advisability of ordering a large quantity of these forms, he pointed out that a much more economical form is feasible in the Valve Division where practically all dimensions are read on dial gages instead of micrometers. He then drew the form shown at top p109 discussing its design with the men who were to use it. Special features of this form include:

1. Fifty columns wide enough for two digits representing the last units of 0.0001 in. in which most dimensional values in the Valve Division are read. This automatically extended the life of the new chart by 61% over the chart borrowed from the other division.
2. Three extra columns at the end of the chart which can be used in case samples in the main body of the chart show lack of control and the assignable causes are eliminated. In such cases, sample values under consideration should not be included in the calculation of the process average and range. This permits an automatic count of the number of samples charted, m. This is convenient for computing $\bar{X}$ and $\bar{R}$ ($\bar{X} = \Sigma X \div m$, and $\bar{R} = \Sigma R \div m$).
3. Numerals from one to fifty in the space between the chart for averages and ranges. These give an automatic count of the samples charted even on charts not completely filled.
4. Scales for averages and ranges, indicated by the heavy numerals, are repeated twice across the chart to relieve eyestrain and minimize errors in plotting.
5. A heavy solid line marked zero on the chart for averages. This usually corresponds to the specification mean of bilateral tolerances as a point of reference on the dial gage, and is the value usually sought. It also serves as the preliminary guide to proper setup on most operations.
6. Every other line on the chart for averages is heavier so units of 0.0005 in. and 0.001 in. can be identified readily. This helps to decrease errors in plotting and also relieves eyestrain.
7. On the basis of many chart analyses in this division, it became

FIRST FORM WAS CLUMSY . . . PRESENT FORM SPEEDS RECORDING OF VALUES



For micrometer readings—Forms in the Accessories Division progressed from first crude blueprint, left, to improved printed form (not shown), to present form, right. As most entries are micrometer readings, wide column-spacings are provided. Vertical lines are centered below columns of numerical values to speed plotting. Chart accommodates 31 samples of as many as six pieces each. Plotted points are not connected

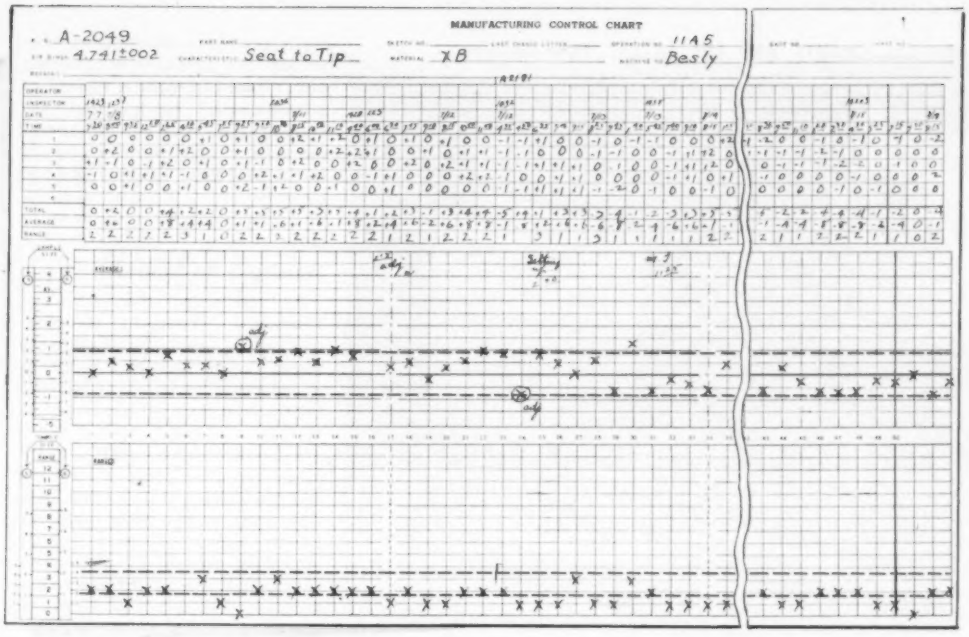
obvious that most required tolerances could be met economically if operations were control-charted on machines discriminately selected. Consequently, **the new form incorporates two sets of scales based on the theoretically derived maximum range which, if not exceeded, gives process variability corresponding to the tolerances required.** Scales are provided for samples of five and six values and are placed on each side of the main scale for averages and ranges. Circled numerals 5 and 6 refer to sample size and thus prevent error in selection.

This amounted to setting control-chart values on a standard that need not always be met by the process. But it also is true that many tolerances are wider than the natural limits of variability of controlled processes. When such is the case, adherence to control-chart values based on the true process range is uneconomical. Therefore the auxiliary scales are used discriminately; their inclusion does not replace the 3-sigma standard limits based on the process range.

8. Two auxiliary scales printed in small numerals on the side of the scale for ranges also provide an automatic estimate of the natural variability of the process based on the true process range. To illustrate, if the process range, when extended into the scale immediately adjacent to the limiting vertical lines for the chart for ranges reads 2.5, the estimated process variability is plus and minus 2.5 or 5.0 of the units in which the tolerances are given. This eliminates calculation of the probable spread of the individual values which, though not plotted, always should be compared with the tolerances required. It also must be ascertained if the percentage of substandard quality produced by controlled processes not contained within specification limits is to be readily calculated from the table of areas of the normal curve.

Adaptations of the Basic Form

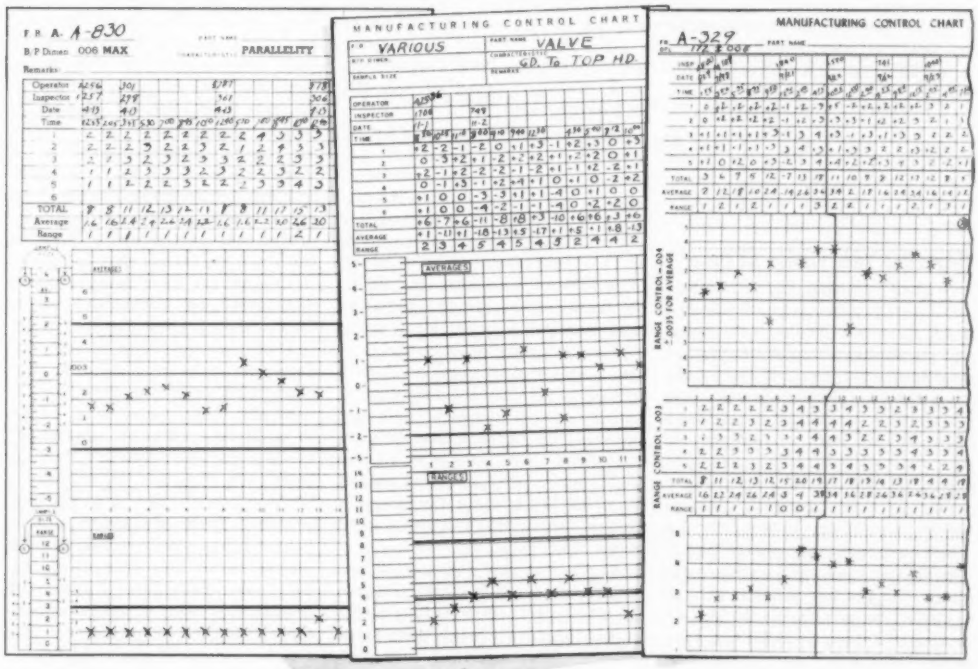
An adaptation of the basic chart is one with a scale for characteristics that cannot be read as plus and minus values, such as, parallelism, out-of-round, and so on. In



FOR DIAL-GAGE READINGS

BASIC CHART, above, was designed to speed charting when dial-gage readings are recorded. Fewer numbers need be recorded

ADAPTATIONS, below, suit specific conditions. At left is form for tolerance in one direction; center form is printed on both sides; at right is form for charting two characteristics simultaneously



PERPETUAL CHARTS ARE THE LATEST TIME-SAVER

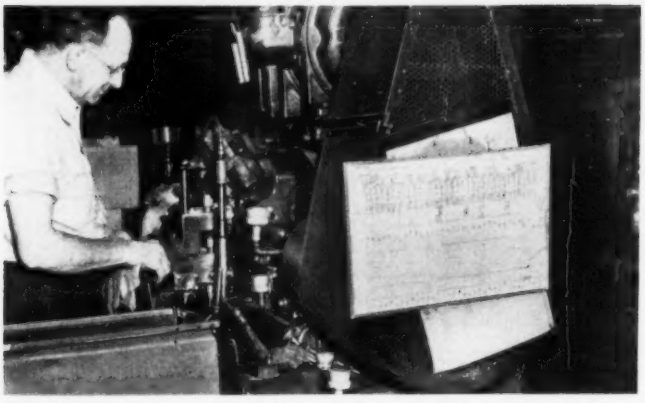


Chart-holder on machine consists of metal frame with transparent acetone face. With blank chart in holder, values are crayoned directly on acetone sheet, then wiped off when form is filled. Charts are used over and over

another variation the main body is the same as the basic chart but, for greater economy of use, the form is printed on both sides so it accommodates 100 samples. The standard scale for averages and ranges is at the left margin of the chart. The blank space of the first vertical column accommodates any scale chosen. However, on many of these forms, control-chart values based on the auxiliary scales of the basic form are incorporated as printed control-chart limits across the body of the chart. Naturally, such charts are issued only for operations which may be relied upon, although any of the forms described will serve multiple purposes.

Charts for Two Values at Once

A third adaptation is used when two closely associated characteristics, such as valve-head thickness and parallelism, should be charted simultaneously. On this form only averages are plotted. Range control-chart values, determined either from past experience or from the tolerances required, are given on the left side under the heading "range control." Range values merely are entered in the range row across the chart. This is feasible, as, even on forging operations, ranges are seldom out of control. Needless to say, if lack of control of ranges is indicated, corrective action is taken. The form is used to good advantage even on machining operations.

Perpetual Charts Save Time

Latest move to effect operational economies is what might be called a perpetual control chart. Introduced about six months ago, this consists of a metal frame which holds a blank chart and is covered with an acetone sheet that acts as a glass pane. Values are entered and plotted on the transparent pane, then are wiped off and the process is repeated.

As special thick crayon must be used, wide column spacings are desirable, so the form developed for the Accessories Division is used. Wiping off requires little time so the original reason for 50 columns to the form is no longer of much importance. To be sure, this leaves no permanent record of the operation charted. Consequently, the practice is desirable only on operations running in very good control on which limited sampling is feasible. Such processes now are so numerous in the Valve Division that most operations are run in this manner. The idea was gained from the Ford Motor Company in Detroit where the method is used at the final assembly.

As the primary function of the control chart is to give guidance for intelligent action on the process when it is out of control or to leave it alone when in control, **such generally prevalent practices as connecting the averages or drawing picket lines of ranges is viewed as a meaningless luxury that has nothing to do with the purpose of the method.** That purpose consists of the statistical analysis and interpretation of the data charted. The principal function of the technique is never compromised.

Training Is All-Important

As mentioned previously, at Thompson Products, statistical method is used for improving methods, regardless of the activity under consideration. Consequently, the training program mentioned on several occasions is of two kinds: The intensive course deals with the larger aspects of statistical method and inductive and deductive logic. The short course deals more explicitly with the technique of dimensional control of measurable characteristics and the method of acceptance sampling. But even in the short course, sound statistical concepts are developed and the logical nature of the technique is tested by considerable experimentation and class practice. Much emphasis is placed on various tests of reliability, a feature sadly neglected in most "practical" courses in quality control. Thus statistics plays a prominent part in many Thompson activities, although in the extensive program of quality control its application and beneficial results are most obvious.

It is believed that the systematic training in statistical method in general, and quality control in particular, has contributed greatly to transforming former distrust of the technique into clear understanding and intelligent acceptance of it. This training was given to some 200 people who were directly or indirectly connected with quality production and inspection, and it is chiefly these people who helped to build the extensive program of quality control now in effect at Thompson Products. Furthermore, because practically all training stemmed from one source, interdepartmental and inter-divisional misunderstandings were prevented. Thus, the Thompson program of quality control is a highly cooperative endeavor—a prime requisite for the success of any program.

How to Mill Die Blocks with Carbides

BY A. O. SCHMIDT
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Fig. 1—Test setup for milling used die block on a 30-hp bed-type milling machine. Two types of 18-in.-dia, 16-blade cutters were tested

Tests with two types of cutters on blocks which varied in hardness from one pass to the next—a difficult job—compare life at various feeds and speeds. Proper speeds and feeds are recommended, and applications up to 2500 fpm shown

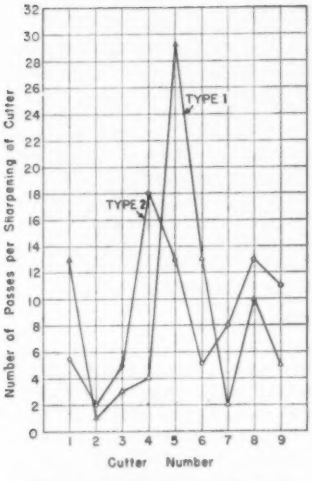


Fig. 2—Nine cutters of each type were tested at 175 fpm, with 10½-ipm feed, 3/16-in. depth of cut, 5 in. wide and 44 in. long. Workpiece hardness varied from 315 to 350 Bhn. Type I cutter had carbide blanks brazed to small steel shanks inserted in the cutter body. Type II had solid carbide blades similarly inserted

RESURFACING forging die blocks is one of the more difficult carbide milling jobs. When the workpiece is a used die block, a high-strength material of 300 to 400 Bhn, inevitable hard spots and cavities will most frequently cause cutter failures.

Milling new, large die blocks of 300 to 400 Bhn has become standard procedure in many shops. One factory which specializes in making dies and which has operators experienced in working with die steels has reported that as much as 1200 to 2000 cu in. of die-block material is removed between regrinds by a 12-bladed carbide cutter as regular production on a 30-hp CSM horizontal milling machine.

Very satisfactory results have been obtained on standard high-powered knee-type milling machines. However, the bed-type milling machine is preferable in general for die-block milling, especially for resurfacing old die blocks. Although the bed-type machine is less versatile, it is more rigid and better adapted to milling comparatively long and heavy workpieces.

In a production-test setup for reworking used forging die blocks on a bed-type milling machine, Fig. 1, two types of 8-in.-dia, 16-bladed carbide cutters were used. Teeth in one cutter (Type I) were formed by brazing carbide blanks to small steel shanks inserted in the cutter body. The other (Type

II) had solid carbide blades inserted in the steel body. Both types had been used extensively in many shops, and, on the whole, had given satisfactory service on most steel-milling jobs. These comparative tests were undertaken with the thought that such a severe milling operation would bring out the relative tool life of each cutter. The same cutters were used throughout the tests, being resharpened after they had failed.

From the graph in Fig. 2, performance of each cutter tested can be seen. Although the number of passes per cutter varied from one regrind to the next, the average was about 9 passes, or 390 cu in. of workpiece material cut for each cutter regardless of its design. Three to four times as much material could generally be cut from new die blocks with these cutters. The carbide blades in either case were of different grades and manufacture, but each kind had been recommended for this sort of heavy milling and had been ground according to the specifications of the particular carbide producer. Cutting speed was 175 fpm, feed was 10½ ipm, and the average cut was 3/16 in. deep, 5 in. wide, and 44 in. long. The workpiece varied in hardness from 315 to 350 Bhn.

Cavities and Hardness

Of course, cavities and variations in the microstructure of the workpiece were primarily responsible for the comparatively low number of passes per grind. Measurements of hardness in the workpiece did not indicate that a low number of passes per cutter was the result of a great increase in hardness.

Sharp cutters usually required from 16 to 18 hp, but as cutting proceeded, the dulling cutters needed 23 to 25 hp. When a number of 8-in. dia, 10-bladed cutters were used on this job, they gave a similar performance in relation to the number of blades. This test confirmed that, as long as there is enough chip space to eliminate chip interference and enough power in the machine to avoid overload, the cutter with more blades will usually remove more material.

In milling workpieces of uniform microstructure having no cavities, carbide cutters will in most cases

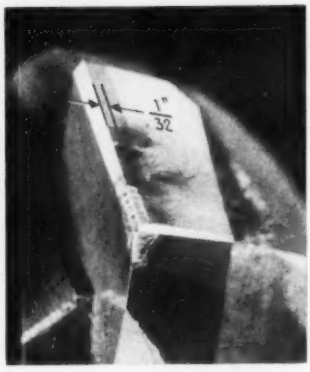


Fig. 3—Uniform wear indicates the setup is correct. Here a 1/32-in. wear land is shown, the usual indicator for regrinding

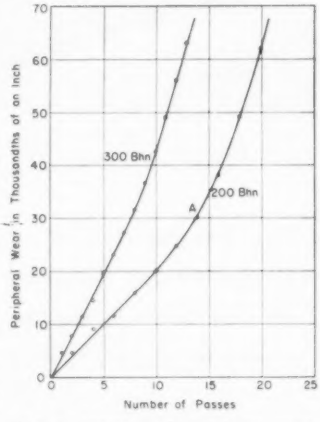


Fig. 4—Increase of peripheral wear on carbide tip when milling steel of various hardnesses at 428 fpm and 0.0115-ipt feed. Point A is illustrated in Fig. 3

wear quite evenly, provided feed and speed, grinding, and grade of carbide are right. It is always an indication that setup conditions are correct when uniform wear, Fig. 3, occurs on the periphery of the carbide blades. A wear land of 1/32 in. is, in general, taken as the indicator for changing and regrinding cutters. Cutter wear is affected primarily by the kind of workpiece material assuming the right type of tool material has been chosen.[1] In Fig. 4 is plotted progressive cutter wear in milling the same steel at 200 and at 300 Bhn. In this case, speed and feed were the same, but it should be remembered that lowering speed and feed for harder materials will usually permit more passes per grind.

When cutting steel of 400 Bhn under the same conditions of speed and feed as those in tests of Fig. 4, tool life was practically zero, see left-hand curve in Fig. 5. Most carbide tips failed in this case by chipping rather than by uniform wear. Milling the identical steel workpiece of 400 Bhn with the same cutter, but at a lower cutting speed of 130 fpm and a finer feed of 0.0045 ipt, resulted in reasonable tool life and quite uniform peripheral wear, see right-hand curve in Fig. 5.

Some carbide grades, however, will fail by chipping and spalling at low cutting speeds even when milling mild steel. On harder steels, frequency of cutter changes and time losses entailed in setup and regrinding are reduced and machining procedure is more economical when lower cutting speeds and feeds are used. It is generally recommended practice to mill 200-Bhn steel at 450-fpm cutting speed and 0.012-ipt feed, 300-Bhn steel at 280 fpm and 0.008 ipt, and 400-Bhn steel at 160 fpm and 0.005 ipt feed. These are preliminary or tentative values, which may have to be increased or decreased depending upon the conditions of machine, workpiece or cutter.

Interruptions

Interruptions or cavities in the workpiece as well as hard spots or other irregularities will often be the primary cause of different kinds of failure, of which excessive wear, chipping or even breaking of the carbide tips are the more objectionable. In Fig. 2, cutters making fewer than 6 passes per grind failed so early because of chipping of one blade, Fig. 6. As soon as one blade is damaged in this manner, it will usually cause succeeding blades to break down also because it subjects them to increased chip loading. To avoid excessive repair and regrinding cost, it is usually best to take a cutter off the machine for regrinding as soon as tooth chipping has started.

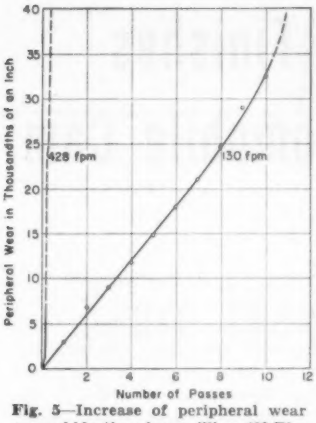


Fig. 5—Increase of peripheral wear on carbide tip when milling 400-Bhn steel. Cutting speed was 428 fpm, feed 0.0115 ipt for the test at left; speed 130 fpm and feed 0.0045 ipt for the test at right. Dotted lines indicate chipping

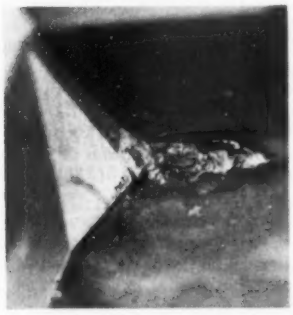


Fig. 6—Chipped cutting edge on a carbide tip

Quite frequently, it has been suggested to mill steel at much higher cutting speeds and feeds.[1] However in most regular production setups it was found that more breakage will then occur and also more tool wear. When checking into a number of reports about steel milling at very high speeds and feeds, it was found that often only a few experimental runs were concerned, or measurements had been incorrectly interpreted, e.g., showing great power savings at high cutting speeds. Higher cutting speeds will make for a smoother-running machine and often eliminate vibration which may cause cutter failure at lower speeds. The power required at the spindle to machine a particular piece of metal with a particular chip size will increase in proportion to the cutting speed. Although there may be hardly any theoretical limit to the cutting speed for light metals like certain magnesium and aluminum alloys, practical and economical considerations have, as yet, hardly permitted cutting speeds above 800 fpm for free-machining steel on ordinary machining jobs.

However, when milling mild steel on rigid and adequate machines, it has been possible to extend the cutting speed above 2000 fpm for carbide cutters and above 500 fpm for those of HSS. In either case, the cut itself was light or shallow, and plenty of effective coolant was provided for the HSS cutter. The teeth of the carbide cutter were cutting only for such a small fraction of a revolution that they were not heated up very much and also they were cooled by their rapid rotation in the air. This advantageous condition is obtained especially when milling with comparatively large slotting cutters. Fig. 7 shows such a successful steel-milling job in which a slot 0.010 in. x ⅝ in. was milled at 2500-fpm cutting speed and a feed of 90 ipm using positive angles on cast-iron grade carbide tips.

The large variety of present-day machining jobs, with regard to their shape, material, physical conditions and tool and machines available, makes the job of production men more important. It is usually the more imaginative and venturesome individual who will bring about better production performance by trying the new procedures based on the knowledge of the numerous factors influencing production.

Savings possible in carbide machining of steel can still be increased in most cases by selecting the particular cutting speed and feed which will not entail too rapid tool wear or chipping, thus eliminating downtime on the machine. This, together with making every provision possible to decrease loading and unloading time, is the most important cost-reducing factor in production milling.

Acknowledgment is made to Fred Crosby and Joseph Roubik of the author's company for help given during tests reported in this article.

[1] *"Influence of Steel Hardness in Face Milling," by J. B. Armitage and A. O. Schmidt, Trans. ASME. Vol. 71, No. 5, 1949, p413-419; American Machinist, Feb. 10, 1949. Vol. 93, No. 3, p98-99.*

[2] *"Are Shop Men Scared of High-Speed Machining?" American Machinist, March 6, 1950.*

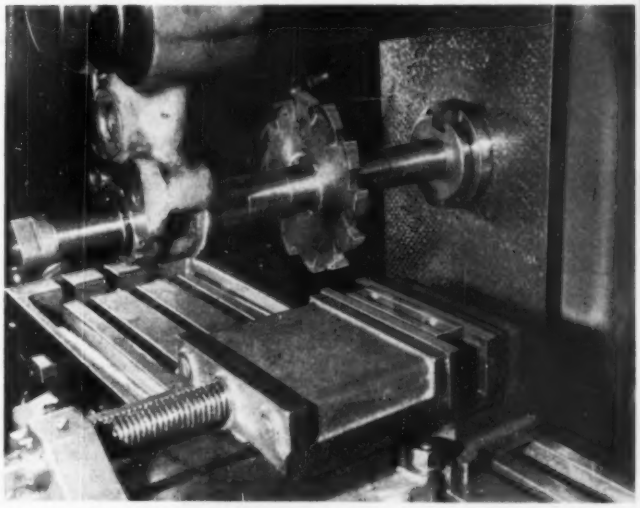
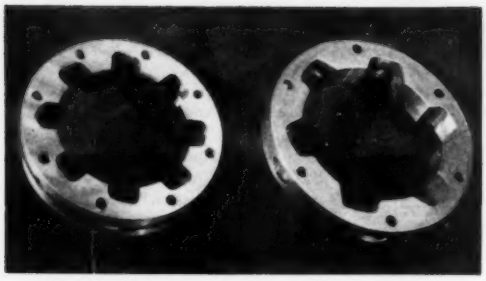
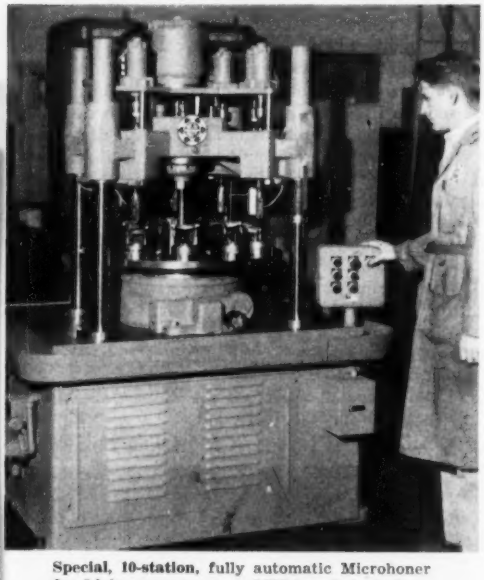


Fig. 7—Shallow slotting a 160-Bhn, SAE 1010 workpiece held in a vise. Slot 0.010 x ⅝ in. was milled at 2500-fpm speed and 90-ipm feed and 500 pieces per grind were produced. Carbide is cast-iron grade, ground with positive angles

Honing Finishes An Automobile Cam



Free-wheeling cams for automatic transmissions are honed on special equipment to obtain straight, accurate bearing surfaces on the lobes



Special, 10-station, fully automatic Microhoner for 8-lobe cams removes 0.002 in. of stock from each surface at rate of 250 pieces per hr

Automatic clamps release the work when it reaches the unloading station, and hold the new piece as soon as it is indexed to the first working position

BY MYRON P. ELLIS, MICROMATIC HONE CORP.

BEARING surfaces on the free-wheeling cams for one of the new automatic transmissions present an unusual machining problem. Each cam has several bearing surfaces—six or eight in the various types of transmissions—upon which rollers ride to control the action of the stator as engine speed changes. For maximum efficiency and service life, bearing surfaces must be square with the sides of the cam, and they must have a true radius and a characterized surface finish that will permit the rollers to move freely without wearing or peening the cams. Several cams are required in each transmission, so production is high.

The cross-hatched surface and true geometrical accuracy generated by Microhoning were known to be ideal for the load-bearing surfaces. But as each surface is generated from a different center, the conventional equipment and technique for splines and other surfaces could not be used. The difficulty was overcome by the development of a special machine by Micromatic Hone Corp.

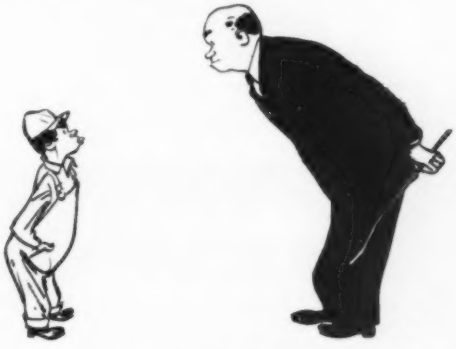
Cams are located and clamped in rigid workholding fixtures. Eight or ten fixtures (two more than number of bearing surfaces on the part) are mounted on a rotary indexing table. Rigid, one-stone tools, one for each cam surface, are mounted in a common head, and are positioned so each one hones a different surface from its own center and generates a true radius. The head is stroked and the tool oscillated mechanically, the motions being adjusted to give full coverage of the bearing surfaces. Combination of the two motions breaks up the cutting path of the abrasives and develops the cross-hatch pattern that keeps the abrasives dressed. Tools are expanded by air or hydraulic cylinders.

Two index positions are provided for unloading, loading and checking the parts. As the fixtures come into these positions the clamps are released, the finished parts removed, rough parts placed in the fixtures, and the location of the cam surfaces checked. As the part is indexed to the first working position it is automatically clamped.

Cycle time is 12 or 15 sec per bearing surface, and one part is finished at each index. Production is 240 to 250 parts per hr. Approximately 0.002 in. of stock is removed from each surface, providing straight, accurate bearing surface that will stand up under the severe camming action with a minimum of wear and friction.

ROUND TABLE

Spare the Rod



"Say, Al, according to what I just read, it's silly to give guys all these privileges; coffee, rest periods, music, and color-painted shops are all the bunk."

"That isn't the way I've heard it, Ed. They tell me that when you make conditions better for the worker, he works better."

"Yeah, I know—the modern sweetness-and-light routine! But these guys took a group of women, gave 'em various privileges, and got production up each time. Then they took all privileges away from 'em—and production went up again."

"Well, maybe a woman works better when she's got somebody to be mad at. But from what I've seen of 'em, you've got to go easier with them than you do with men. I suspect the answer is that the gals react favorably to change—even if the change is bad."

"Nuts, Al! Everybody works better if he's got somebody to gripe about. If the boss rides the employees, they work harder just to show the old so-and-so."

"That might work for a little while, but not for the long pull, Ed. I still believe that the boss who is human will get better cooperation, and that teamwork is better than slave labor."

"Who said anything about slave labor? You make it sound like a boss who expects a day's work for a day's pay and doesn't plaster the place with frills is a slave driver. What are we running, a club or a shop?"

"The idea of keeping your nose to the grindstone, with no chance to take a breather, is pretty well-outdated, Ed. If so many plants are making themselves pleasanter places to work in, there must be something to it."

"Not much. What's become of the guys who tried to do an honest job and didn't spend all their time griping about too much heat, or not enough locker space, or how high should a stool be? There are only a few oldtimers that go at the job, not at bellyaching."

"That's the way it has always been, Ed. The young fellow is always trying to improve things; the old one just gets tired and takes 'em as they come. If you can give the young fellows some challenging jobs and get 'em interested, they won't gripe about working conditions, maybe. And besides, I read the other day that it's the griper who's the best man."

"Well, then, let 'em *all* gripe! Why give 'em any doodads?"

"Why not? Why not let a man smoke, and take a break now and then, and have a paid vacation, and so on? There's no point in being tough just to be tough."

"Yes, there is—look at the Marine Corps. They make men, not sissies."

"You mean, Ed, that treating a man like he's human will make him a sissy, eh?"

"That's right, Al. We ought to work while we're working, and cut out the folderol."

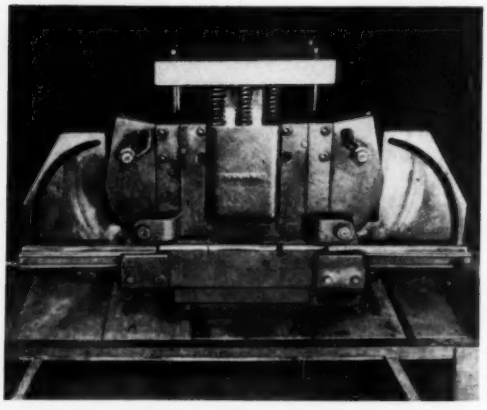
***DO EASIER SHOP CONDITIONS** result in lowered output? Lower morale? What about privileges; do they spoil good men? Your opinions and ideas on this subject will interest others. Discussions of earlier topics appear on later pages.*

1 Front and rear guards give rider's legs protection. Tubes are bolted to bike frame at ends, held in collars at center. Fabrication takes place in ...

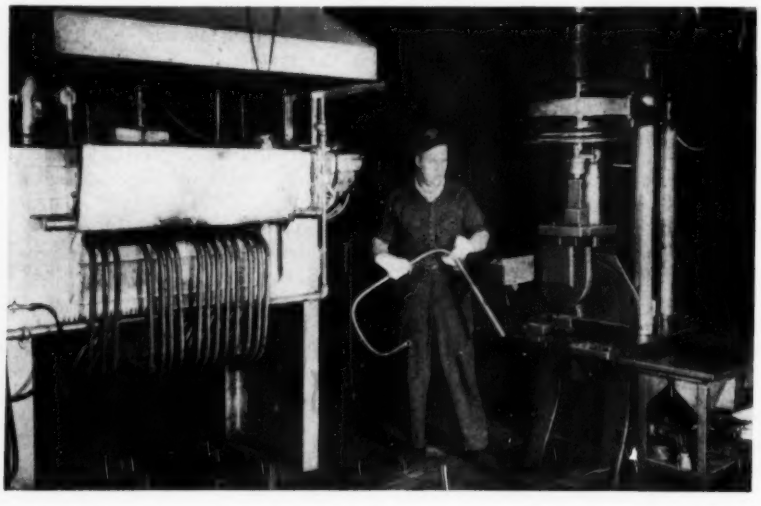
LEVER DIES MAKE MOTORCYCLES SAFER

BY R. P. VAHLDIECK, Tool Engineer,
HARLEY-DAVIDSON MOTOR CO.

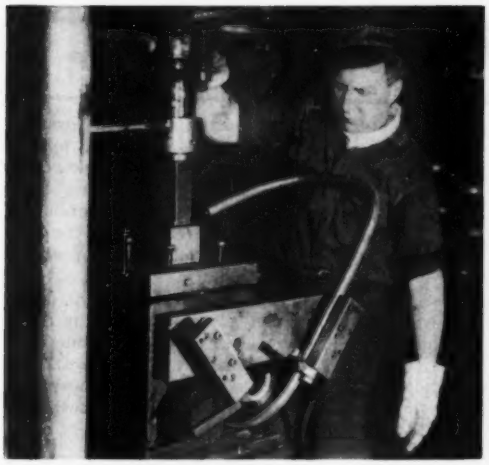
THE front and rear safety guards that help save "motor-bike" riders from scrapes and burns in a sideways spill are compound-bent to their odd shapes in three lever-action die operations from SAE X-1025 stainless-steel tubing. Stock is 63 to 68⅝ in. long, and is 1-in. or ⅞-in. tubing with 0.120-in. or 0.109-in. walls, depending on whether the guards are for heavy or light motorcycles. This hot-forming process makes it possible to utilize uncomplicated dies in screw presses. Preheating to soften the stock for bending and flattening takes place in gas-fired furnaces at 1600 F. A double-end die makes the two primary 5-in.-radius bends, and a single-bend die makes two secondary 6.5-in.-radius bends because two positions (left and right) are built into it. Die action utilizes wedges that swing grooved shoes which wipe the stock into grooved dies, making bends without collapsing the tubing.



...**2 Lever-action press.** This one, for first double bend, shows principles of the others. Tube is heated at bend points in furnace, then located in die against end stop at left. As ram descends, straight grooved forming blocks swing out, up, and around, guided by pins through slots in wing plates. Ram exerts spring pressure against center section of stock to grip it firmly. Next operation is at . . .



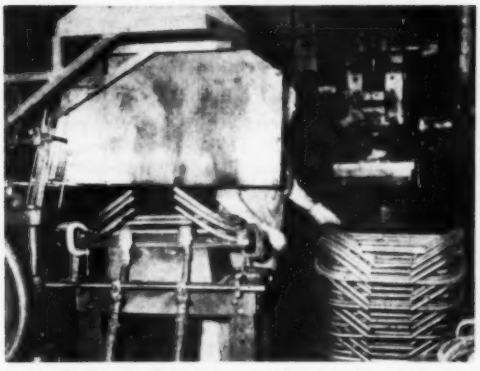
...**3 Furnace-and-press setup** where secondary bends are made. Heating makes bending easier in the General No. 203 screw press—the same press used for all bending stages. Die has two . . .



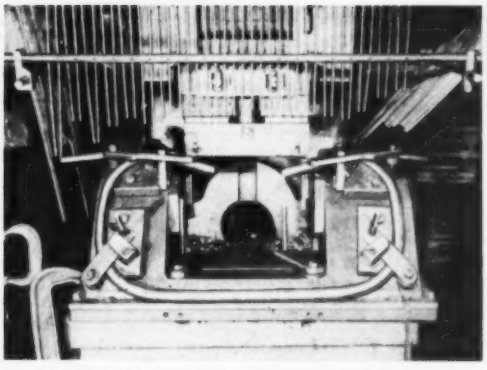
...4 **Clamp Locators,** which grip stock for single-action left- or right-hand bend. These hold the center section steady while one end is bent by a . . .

...5 **Swinging shoe,** which presses tube end around grooved die block that is held down, through springs, by the ram. Forming block, or shoe, has a wiping action. Next stage is . . .

...6 **End-flattening setup** with gas heater located next to Bliss horn press. Stock handling is done on skids with guard tubing interpiled to increase load efficiency. First job is . . .

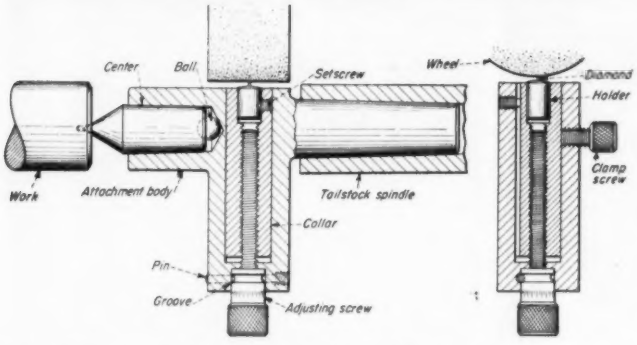


...7 **Preheating,** done three guards at a time. Operator picks up the pile, drops off the bottom (hottest) guard, replaces pile in heater, and adds a new guard. Then, he moves to . . .



...8 **Heavy press** where quick-acting clamps locate the work. One stroke of the ram presses the heated guard ends down and squeezes them against the sides of the die to flatten and turn them

Practical Ideas



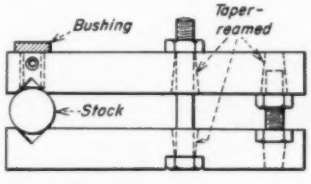
Grinding-Wheel Sizing Device Dresses Semi-Automatically

DURING LONG RUNS on the cylindrical grinder, it improves precision and reduces operator fatigue and confusion if the wheel can be dressed repeatedly to the same figure on the dressing-attachment dial. The advantage of this attachment is that the diamond point is always a fixed distance from the axis of the work.

The body of the attachment is machined so it fits directly into the tapered tailstock spindle of the grinder. A short center, fitted with a bearing ball and knockout hole, is at the other end of the attachment. This supports the workpiece in place of the usual center, and allows the attachment to remain in the machine throughout the run. Thus, the dressing attachment is handy at all times, and has only to be shifted to the left (by shifting the table) to be in position to redress the wheel.

The diamond holder is held by a setscrew in the counterbored end of a round collar that slides inside a hole in the body of the attachment. The collar is prevented from rotating by a key. The diamond is adjusted by a long screw that engages an internal thread in the collar. This screw, which has a graduated dial on its end, is prevented from coming out of the attachment by a pin through the body which engages in a circular groove around the knob of the screw. The graduations on the knob provide accurate means of controlling the advance of the diamond point.

A workpiece is first roughed nearly to size when a new setup is being made. Then the wheel is dressed by the diamond point, and a semi-finishing cut is taken on the work. The work is checked for size, and half the remaining measurement is the amount the diamond is advanced. Now the wheel is dressed again, and the work is finish-ground. *Tom Brown, Middlesex, England.*

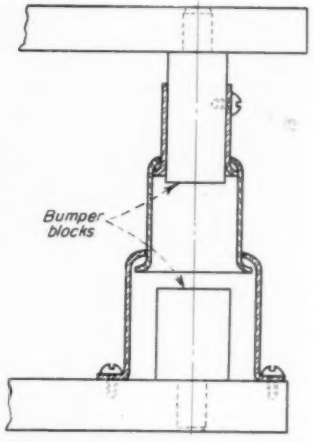


Shaft-Clamping Fixture Eases Cross-Drilling

THIS CLAMP makes accurate drilling of cross holes through shafts easier, and helps to space the holes accurately when either round or flat stock is to be drilled in a number of spots.

Dimensions are not given because they must be picked by the clamp maker. The V-grooves across the jaws should be milled with both jaws in the same setup for accuracy. The bushing hole should take a standard set of bushings. Slot the recesses for the two bolt heads to hold them to prevent their twisting.

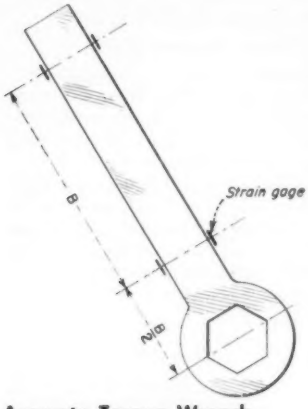
Accurate spacing of two holes through a shaft or plate is done with pieces of drill rod inserted in the bushings. The rods should be a close slip fit. A measurement across the drill rods can be taken with calipers or micrometers, then the rods can be removed and drills inserted. *R. C. Hoard, El Paso, Texas.*



Telescoping Guard Covers Bumper Blocks

MASHED HANDS are sometimes the result when a setup man tries out a new die in a press and gets in the way of the bumper blocks; and this accident can happen to the regular press operator, too. This guard should eliminate that danger, and may be applicable to other cases.

The guard is made from sleeves, which can be either turned or (more economically) spinned. They should be decently heavy stock, however, and should work smoothly. *F. A. Adams, Dayton, O.*

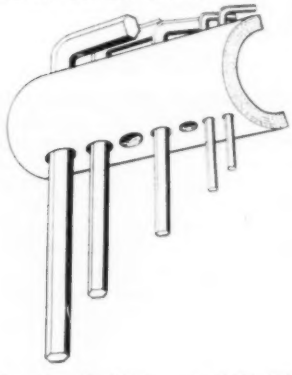


Accurate Torque Wrench Utilizes Strain Gages

BY MAKING a torque wrench with strain gages attached to the arm as illustrated, it is possible to get direct readings on a Wheatstone bridge circuit that is calibrated in ft-lbs or in.-lbs. This idea eliminates the factor of friction in spring-loaded torque wrenches, which has an adverse bearing on accuracy. *Chester S. Ricker, Detroit, Mich.*

Wrench Holder Made From Half Hose

HERE'S HOW workers carry their socket-head wrenches on the assembly floor of a plant that produces precision tools. The full set of wrenches is carried in order; any one wrench can be easily picked out of the holder; and the hose prevents finished surfaces from getting scratched. *Chester S. Ricker, Detroit, Mich.*

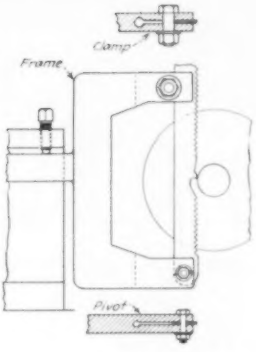


Sawblade Tool Does Lathe Cutoff Work

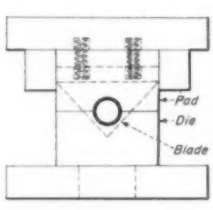
WHEN CUTTING OFF large-diameter stock on a lathe, the cutoff tool needs a wide section for strength, yet should be thin to save stock. These tools are usually expensive, and require careful grinding. All this expense can be reduced by grinding an old hack-saw blade to make the cutoff tool.

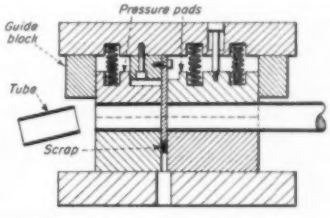
The blade is ground, as shown, to the proper rake and clearance angles. The edges of the blade are ground, too, to remove projections on teeth which might interfere with the stock as the blade penetrates. Care is necessary in grinding to see that the cutting point is not burned or drawn.

The blade is suspended tightly between the arms of the C-frame holder. The lower end of the blade can be held by a bolt through the hole, and the upper end can be gripped by the split arm of the frame. As shown, the tool would be used on the rear slide of the machine, but it could be mounted on the front or could be swung from a turret as well.



This cutoff tool should be fed slowly and coolant should be applied. A high cutting speed sometimes gives good results (the work is turned fast). Hard or high-tensile steel is not easily cut this way, but mild steel, brass, cast iron, and bronze are cut easily. *Nobuo Arakawa, Tokyo, Japan.*



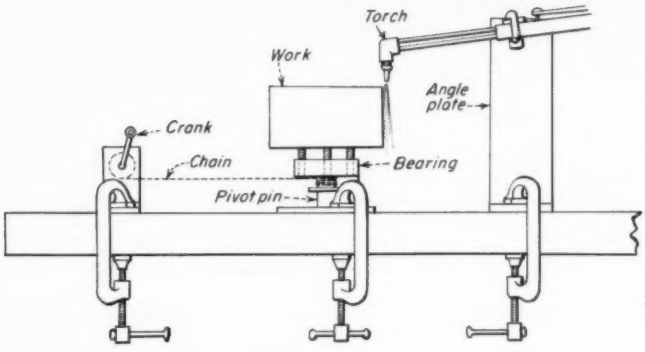


Slitting Punch and Die Cut Off Tubing

RECENTLY we had the problem of cutting off a large number of lengths of tubing. We tried a band-saw first, but this proved to be too slow and costly. The punch and die we designed cut off 3-in. lengths of 1-in. tubing with a 1/16-in. wall thickness, and did it rapidly and with little burr left.

The die had to be designed to prevent distortion of the tube while it was being sheared. We took care of this difficulty by making two die members to fit exactly around the tubing to support it from all sides. The shearing punch was V-shaped, and operated in a slot through both members.

The top member, which was actually a spring-loaded pressure pad, came down with the ram. It was guided by side blocks, backed up by six coiled springs, and was held in the die set by retaining screws. The shear blade was 3/16 in. thick, and produced a ring slug that dropped through the lower die The only deformation was a slight indentation at tl e top of the tubing where the point of the punch entered. *Kenneth L. Stoltenberg, Milford, Mich.*



Rough Shop Cranker Torch-Cuts Round Blanks

PULLEYS, PINIONS, and any small wheels up to about 8 in. thick and 2 ft in dia are cut in our shop with a torch from rough stock, but our regular burning machine will not cut these sizes accurately, so we had to do the job by hand. Recently we made a turning attachment that made such cutting accurate.

The rig is mounted on a large shop table, which holds an angle plate for the torch and a suitable base for the turning mechanism. A pivot pin and an old automobile-wheel thrust bearing support a plate that has three heavy setscrews. These support and level the work. Because the work is normally quite heavy, no clamping is required.

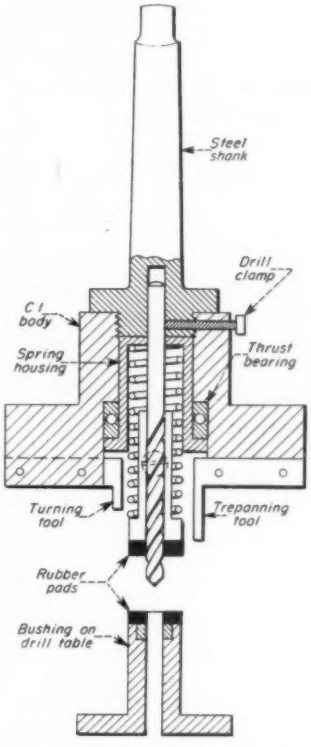
A bracket is attached to the table some distance from the pivot. This carries a crank and chain sprocket. The chain itself is attached to the pivot at one end and is wrapped around the sprocket at the other, allowing the crank to be turned to revolve the work.

A similar arrangement has been thought of, but not tried out yet, using a pulley and weight to haul the chain. A simple clamp holds the welding torch to the upright angle plate, which is clamped to the table. *Matthew Gladd, Hubbard, O.*

Drillpress Washer Cutter Clamps Around Drill

BAKELITE, sheet steel, and other materials are cut from flat stock with a combination drill tool that includes a drill, a turning tool, and a trepanning tool.

The drill penetrates the sheet first, forcing the stock down on the rubber pad in the drill bushing that backs up the material. Then the center bushing—also rubber-tipped—touches the work and stops



rotating. As the drill handle is further depressed, the trepanning tool cuts the OD of the washer, and finally the turning tool cuts the washer to size and cleans up the edge.

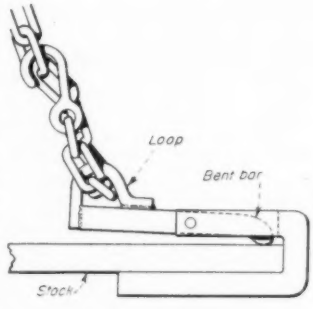
A compression spring that backs up the center bushing exerts enough force to hold the washer to keep it from moving while being cut. *Allan Clarke, Rochdale, England.*

Plate-Lifting Hook—Simplified

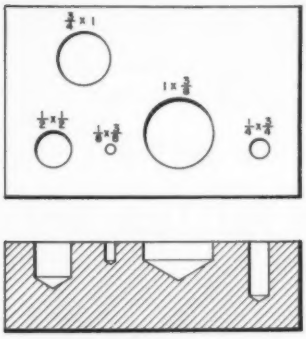
A PLATE HOOK used in our shop is similar to, but far simpler than Mr. Frommer's idea (*AM* Nov 27, '50, p 132).

Our hooks are 1 x ½-in. bars about 15 in. long and bent to a close U-shape. One end of each is milled out to form a ¾-in. slot and is drilled for a ½-in. pin. The clamp for each is a 1 x ¾-in. bar bent at one end to form a cam shape and with a piece of ½-in. rod welded to the other end to form a loop.

The plate hook is simple, foolproof, and inexpensive. The adjustable feature in Mr. Frommer's idea



is provided for by running the chain through the loop and hooking it back upon itself, as illustrated. *Frank M. Butrick, Jr, Alma, Mich.*



Depth Templet Helps Drill Sheet Stack

IF YOU HAVE to drill holes to various depths and diameters in sheet material, a great deal of time can be saved with this depth setup block.

Take a piece of steel the same thickness as the material you are drilling and cut holes in it to the various depths you require. Make the holes to the various diameters, and mark them for easy reference.

Place the templet on the drill table, bring the drill down to depth in the proper hole, clamp the depth-controlling nuts on the press, then remove the templet and start work. *Fred Lettino, Astoria, N. Y.*

Chuck-Changing Hook Improved

LOOKING THROUGH some back issues of AMERICAN MACHINIST I noticed an idea that is good but stops short of the solution to the problem. This was an idea showing a heavy hook for changing chuck jaws (*AM* Feb 10'49, p 121).

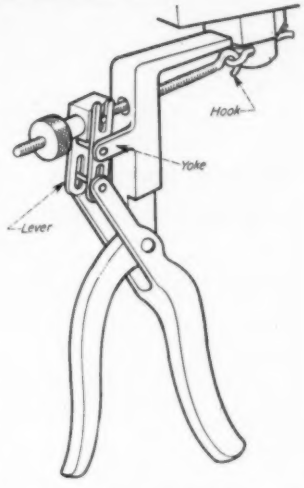
How would you remove a chuck from a non-reversing lathe with the jaws clamped on the hook and a crane hooked into the ring? Wouldn't it be better to slip a sleeve on the horizontal section of the hook and weld a washer on the end to hold it?

The jaws could then be clamped on the pipe sleeve and the chuck would still be free to turn in either direction. *Thomas E. Chandler, Paducah, Ky.*

Punch-Like Tool Extracts Cotter Pins

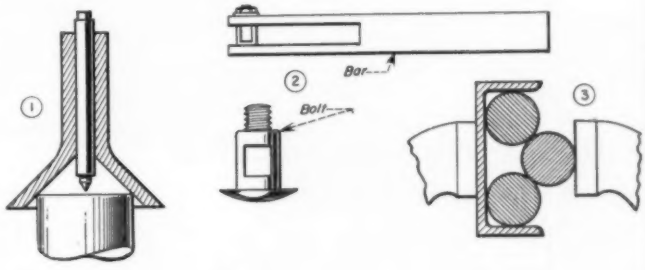
THIS HOME-MADE DESIGN is for pulling stubborn pins that can't be removed with the tang of a file.

The hook is inserted in the eye of the pin, the arm of the tool is placed against a nut or the shaft through which the pin fits, and the handle is tightened. The short lever works on a pin through a yoke in the frame of the tool to pull back the threaded hook rod. The thumbnut allows quick tightening



or backing off of the hook rod.

An office hole punch can be adapted to make this tool, or its mechanism can be copied partly to make an original tool in the shop. *Charles H. Willey, Penacook, N. H.*

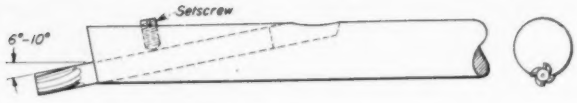


Three Shop Ideas Save Tooling Time

1. CENTER MARKS in round shafts and bars with any number of regular, equal sides are made with this device. The idea is not as well known as it should be. The inside taper at the end of the holder should be accurate, and both holder and punch should be hardened.

2. BORES in long, blind holes are made easily with the illustrated cut-out bar. A toolbit is gripped in the threaded bolt by a setscrew (not shown), and the bolt is held in the bar by means of a simple nut. The tool can be quickly adjusted to practically any angle or position.

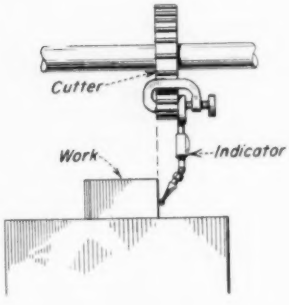
3. SMALL BARS for miscellaneous shop jobs are cut off easily when gripped in the jaws of a vise with a piece of channel iron holding them. The channel iron can be picked large enough to hold more than three pieces of stock, if desired. *H. Woerle, Augsburg, Germany.*

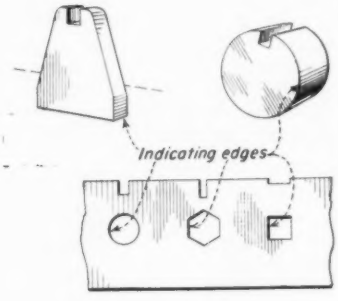


Boring Bar Has End Mill for Bit

NEW OR REGROUND end-milling cutters act as toolbits in this boring bar. We find this method of boring more accurate than with a conventional toolbit, and the cutter has the advantage of a number of cutting edges which can be adjusted to work before the tool must be reground.

With a four-flute, double end mill in position, the bar has eight cutting edges available. We use the tool for finishing only, where tolerances are as small as minus nothing, plus two tenths. When one edge gets dull, simply rotate and reclamp the cutter. *Osmer N. Gorton, Jr., Pearl River, N. Y.*





Indicator Clamped to Cutter For Reference Setups

WHEN A CUT in a workpiece must be located from a reference side of the part in a milling setup, it is customary to clamp the work, move the table to touch the reference side to the cutter face, then shift the table over the required amount. But if the reference side of the part is rounded, undercut, or inaccessible for any reason, a dial-indicator setup can duplicate this locating method.

A squared block is clamped on the milling table and is indicated so a side is square with the plane of the cutter. The table is moved to touch the side of the block to the cutter, then side motion is locked. The table is then lowered so there is clearance for the work and the dial indicator, which is to be mounted on the cutter.

Now a dial indicator is fitted with a support rod, and this is clamped against the far face of the cutter with a C-clamp. The indicator is adjusted to touch the reference face of the block, and the bezel of the indicator is adjusted to zero.

Finally the block is removed, the work is clamped on the table, and the table is unlocked and shifted until the reference face of the part touches the indicator tip and the dial reads zero. Now the face of the cutter is directly above the face of the work, and the necessary shifting of the table can be done. *Clarence B. Winch, Tonawanda, N. Y.*

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for the best

PRACTICAL IDEA

An extra payment of $25 will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT— $25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES — A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS —Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author —every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42d St., New York 18, N. Y.

122nd Winner:

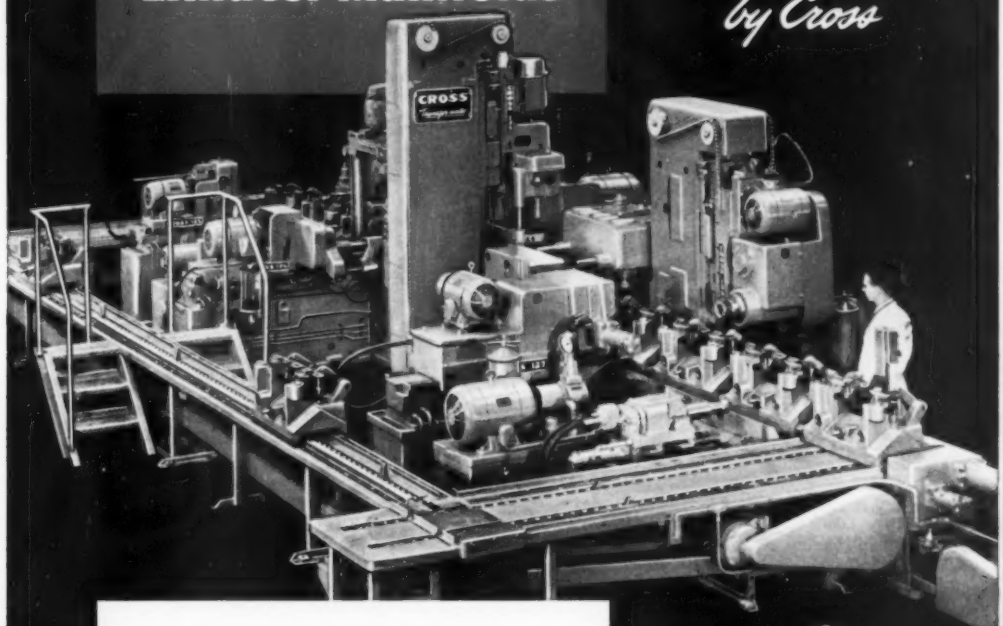
(For February 19 issue)

Marc Bell

Dial-Indicator Setups

Mills, Drills, Bores, Reams, Chamfers and Taps Exhaust Manifolds

Another Transfer-matic by Cross



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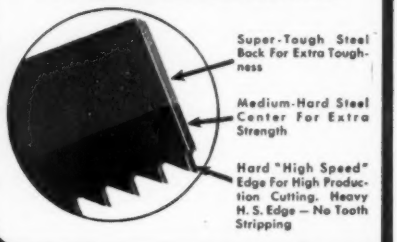
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Machining Gas Turbine Alloys . . . I

BY K. J. B. WOLFE, research manager, and P. SPEAR, senior research assistant,
B.S.A. GROUP MACHINABILITY RESEARCH LABORATORY, BIRMINGHAM, ENGLAND

Three basic problems have arisen in machine shops because of the development of the gas turbine. These problems are: (1) the need to process materials with worse machining properties than even the most difficult conventional constructional steels, (2) requirements for better finish and closer tolerances than normal, and (3) difficult inspection.

Following data represent optimum machining conditions for some of the ferritic and austenitic steels and alloys listed, but in some cases only reasonable practice can be predicted, considering the newness of the materials. Standard tool designs may be used to get into production as soon as possible, but the peculiar machining characteristics of the turbine alloys suggest the desirability of using only most suitable tool designs and tool materials.

Machining Characteristics—General machining characteristics of gas-turbine alloys are:

1. Most materials give rise to a severe built-up edge on the cutting tool. Hence, coolants must have good extreme-pressure-lubricating properties.

2. Ample coolant supply is required to carry away excessive heat generated in cutting.

3. Cutting action must be continuous (this does not apply so much to ferritic steels), because the alloys work-harden or glaze. Considerable difficulty arises in machining austenitic materials with feed or depth of cut less than 0.002 in. especially if the parts have been rough-machined previously.

4. Keen-edged, smoothly finished tools are essential, and special surface treatments may be needed to reduce friction of the chip.

5. Because the materials are abrasive, tool failure is characterized by abrasive wear and minute chipping of the cutting edge.

6. Machined surfaces, particularly of austenitic materials, are bright but not necessarily flat, because of the burnishing action arising during cutting.

7. Chips are tough, ragged and loosely curled, thus indicating the need for adequate chip space in multi-tooth cutters.

8. Negative rake angles are of little value because the alloys do not soften or lose strength at cutting temperatures.

9. Because cutting forces are three to four times greater than for constructional steels, care must be exercised to design jigs, fixtures and machine tools with adequate strength, and to reduce tool overhang to a minimum.

Cutting-Tool Requirements—Fundamental requirements for tool materials applied to gas-turbine alloys are: (1) abrasion resistance, (2) ability to withstand high cutting temperatures, (3) toughness to withstand shock loading, (4) high modulus of elasticity to minimize deflection, (5) ability to take a keen edge and fine finish—carbides should be of maximum density and small grain size, and (6) the cutting edge should fail slowly by abrasive wear instead of cratering, which work-hardens the surface of austenitic alloys and produces scrap.

Two types of high-speed steel that give good results are listed in Table II. The high-carbon vanadi-

Table I—APPROXIMATE COMPOSITIONS OF AUSTENITIC AND FERRITIC STEELS AND ALLOYS

General Classification	Country of Origin and Type	Chemical Composition, wt.%													
		C	Mn	Si	Ni	Cr	Co	W	Mo	Nb	V	Ti	Al	Cu	N
Ferritic Materials															
3% Cr–Mo–V	Britain (H27)	0·4	0·6	0·3	...	3·0	...	...	0·8	...	0·2	...	...	...	...
3% Cr–Mo–W–V	Britain (H40)	0·23	0·3	0·4	0·3	2·7	...	0·5	0·5	...	0·75	...	...	...	...
12% Cr–Mo–V–Nb	Britain (H46)	0·19	0·39	0·17	...	10·7	...	...	0·47	0·15	0·63	...	...	...	...
Austenitic Materials															
Improved 18/8 type stainless steel	Britain (R20)	0·1	0·8	0·3	14·0	19·0	...	...	...	1·7	...	...	...	...	...
13% Cr, 13% Ni, with additions	Britain (G18B)	0·4	0·8	1·0	13·0	13·0	10·0	2·5	2·0	3·0	...	...	...	...	...
Co-base alloy	Britain (G32)	0·3	0·8	0·3	12·0	19·0	45·0	...	2·0	1·2	2·8	...	...	...	...
14% Cr–Ni–Mo	Britain (R.ex 78)	0·1	0·5	0·5	18·0	14·0	...	...	3·5	...	...	0·75	...	3·5	...
14% Cr–Ni–Mo, with additions	Britain (R.ex 337A)	0·2	0·5	0·5	18·0	14·0	7·0	...	3·5	...	...	0·75	...	3·5	...
16% Cr–Ni–Mo	U.S.A. (Timken)	0·05	1·5	0·8	25·0	16·5	...	...	6·25	...	...	...	...	...	0·1
19% Cr–Ni	U.S.A. (D.L.)	0·3	1·0	0·55	9·0	19·0	...	1·25	1·25	0·4	...	0·3	...	...	...
20% Cr–Ni–Co–W–Mo	U.S.A. (N155)	0·3	1·5	0·6	20·0	20·0	20·0	2·2	3·0	1·0	...	...	...	...	0·1
Co-based Cr–Ni–W–Mo	U.S.A. (S816)	0·4	0·6	0·6	20·0	20·0	44·0	4·0	4·0	...	...	...	...	...	...
Ni-based 20% Cr	Britain (Nimonic 80)	0·06	0·5	0·5	75·0	20·0	...	...	...	...	...	2·5	0·5	...	...
23% Cr–Ni–W	Britain (H.R. Crown Max.)	0·20	0·4	1·5	11·5	23·0	...	3·0	...	...	...	...	...	...	...

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Machining Gas Turbine Alloys . . . II

Table 2—SELECTION OF TOOL MATERIALS FOR MACHINING GAS TURBINE ALLOYS

Material No.	Classification	Typical Composition (%)	Hardness	Advantages	Disadvantages	Application
High-Speed Steel						
1	High cobalt-bearing	0·82 C, 4·75 Cr, 0·60 Mo, 1·60 V, 20·0 W, 10·5 Co	62½–64 Rc	High "hot-hardness," long tool life. Components maintain size. Grinds easily giving a good finish.	Inclined to be brittle, fails suddenly as edge of worn crater breaks down	Steady cutting conditions at heavy feeds (up to 0·035 in. rev. for turning) and high speeds
2	High-carbon, vanadium-bearing	1·25 C, 4·35 Cr, 0·25 Mo, 4·50 V, 14·0 W	64 Rc min. Normally 64–66 Rc; can be 68 Rc	High abrasion resistance, long tool life. Withstands interrupted cutting and high rubbing forces on clearance faces. Wears steadily	"Hot-hardness" not as good at 10%, Co type steels. More difficult to grind	Steady cutting at medium speeds. Interrupted cutting and where exposed to rubbing action as in fast finishing operations
Sintered Hard-Metal Carbide						
3	Cast iron, roughing grade	7 Co, 93 WC; fine grain	1450–1500 V.P.N.	Abrasion resistant, tough, wears steadily	Soft. Life not as long as type 4. Heat resistance not as good as type 5	Finish-machining of austenitics and ferritics. Withstands feeds down to 0·002 in./rev. and some impact loading
4	Cast iron, finishing grade	5 Co, 95 WC; very fine grain	1625–1675 V.P.N.	Abrasion resistant. Fairly tough, but not as good as type 3. Wears steadily. Longer life than type 3, if no impact loading	Heat resistance not as good as type 5	Steady cutting on austenitics and ferritics. Medium and roughing cuts from 0·008 in./rev. up to 0·030 in. rev. for turning
5	Steel, roughing grade	10 Co, 6 TiC, 84 WC; fine grain	1350–1430 V.P.N.	Tough, high heat resistance	Fails by crater formation. Relatively poor abrasion resistance	Heavy steady cuts (up to 0·030 in./rev. for turning) on austenitics without a cobalt base. Seat of cutting must be away from cutting edge

um steel with 14% tungsten, when hardened to Rockwell C64-64½, has the higher abrasion resistance and is less expensive. It has also proved preferable for intermittent cutting, as in finish shaping the concave surface of a rotor blade.

Chromium plating and phosphate coating of tool materials to reduce abrasion have not proved satisfactory. Some proprietary British surface treatments have given good results on drills, broaches, form tools, taps, reamers, cutters.

Cutting Fluids—In the general applications given below, certain operations are covered by two or more fluids. Choice depends on relative importance of cooling, viscosity, extreme-pressure lubrication, ability to penetrate narrow spaces as in drilling and to reach the "seat of cutting." A viscous oil with good lubricating properties may have to be thinned with blending oil.

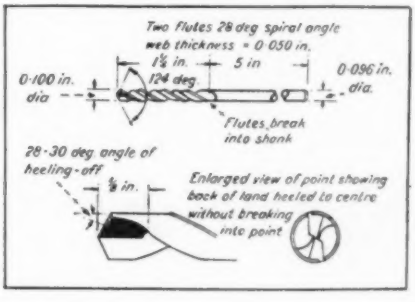
Machining Conditions—Information is given for cuts of two or three degrees of severity on the following four classes of materials:

1. Nimonic alloys, Stellites and cobalt-base alloy G32.
2. Austenitic steels like H.R., Crown Max, G18B and R 22.
3. Lower-alloyed austenitic steels like R 20 and 18-8.

GENERAL APPLICATION OF CUTTING FLUIDS

	Classification	Operations*
1	Heavy, high viscosity, chemically active, E.P. cutting oil	*M, R, T, Tap, Th*
2	Medium, chemically active, E.P. cutting oil	*B, Bor, M, R, T*
3	Milky (or "semi-opaque") E.P. soluble oil, stable at dilutions of 3 : 1 to 5 : 1	*D, M, R, S, Sh, Sl, T*
4	Translucent type, reasonably good E.P., soluble grinding oil with good wetting properties	*DHD, G*

* *B* = broaching, *Bor* = boring, *D* = drilling, *DHD* = deep-hole drilling, *G* = grinding, *M* = milling, *R* = reaming, *S* = sawing, *Sh* = shaping, *Sl* = slitting, *T* = turning, *Tap* = tapping, *Th* = threading.


Two Flutes 28 deg spiral angle
web thickness = 0·050 in.
1⅛ in.
5 in
0·100 in. dia
124 deg
0·096 in. dia.
Flutes break into shank
28·30 deg. angle of heeling-off
⅛ in.
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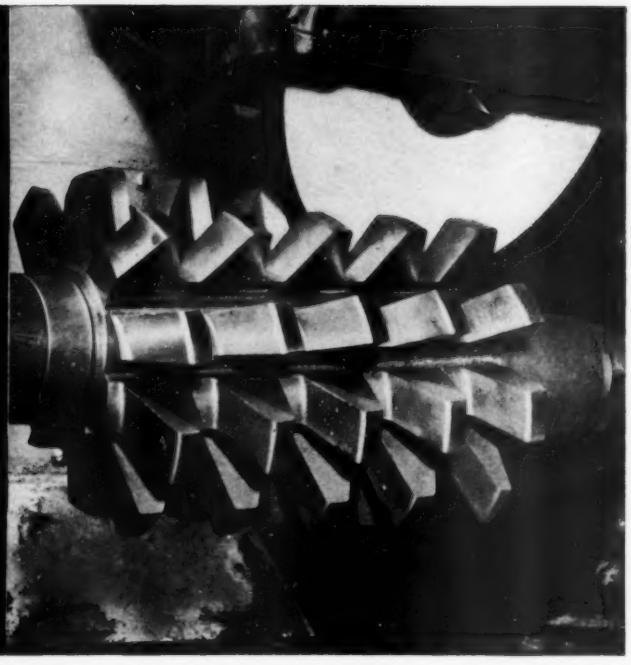

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Large hobs with 1½" or greater pitch may be successfully ground with a 10" x 1" x 1" WA464-J2V Robertson Wheel. On smaller hobs, a Robertson 7" x ⅝" x ¾" RA60-J2V will give highly satisfactory results. There will be no burning and very little heat generated. Experience has shown that you can expect a 50 percent or greater saving in grinding time when you use a Robertson Cool-Cut instead of a conventional wheel for hob grinding.

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Machining Gas Turbine Alloys . . . III

4. Ferritic alloys of medium to high tensile strength such as H40 and H46.

Turning and Boring — Rough turning of billets and disks is normally done with carbide tools, while finish turning is usually done with HSS tools, unless the feed may exceed 0.005 ipr and higher speeds than shown at (*a*) in accompanying table.

Finish turning and profiling of smaller components, and interrupted cuts, are performed with HSS tools.

Milling — Form-relieved cutters should be used, or alternatively clearance angles should be 5 to 8° with narrow primary land about 0.005 to 0.010 in. wide at 2° for cutting-edge support. Helix angles up to 45° have been successful.

Tapping—In machine tapping, leadscrew control of feed is desirable. Cutting speeds range from 10-12 sfpm for Class 1 material to 20-25 sfpm for Class 4 alloys. A 50% effective thread can be machined with one tap, but greater percentages require use of two to three taps.

Drilling—Use drills with thick webs. Hand-feed small drills with little thrust to let the tool cut by itself. For larger holes with depths of seven to ten diameters, use the drill sketched. It is advisable to commence drilling on a center-punch mark consisting of three flats forming a tetrahedron. Reaming should be done at speeds of one-third to one-half appropriate drilling speeds.

Abrasive-Belt Grinding — For stock removal (also machining marks) use an 80-grit belt with seven parts medium-viscosity lubricating oil and one part paraffin. Roughing and semi-finishing operations require 120 grit; finishing, 180 grit, both using lanolin-base grease. Extra-fine finishing may be done with 220 or 240 grit. Belt speed should be approximately 7000 fpm.

Grinding Operations — Wheel wear is usually rapid. A higher than common proportion of soluble oil in the cutting fluid helps to minimize loading. For cylindrical grinding use a 46-60 grit wheel in grades L to N; for surface grinding, 24-30 grit, I to K.

MACHINING CONDITIONS FOR TURNING

Sintered Carbide Hard-Metal Tools (a)

Mat. Class	Tool Class	Speed, ft./min.	Feed, in./rev.	Depth of Cut, in.	Tool Shape
1	4	100–130	0.010–0.020	$\frac{1}{8}$–$\frac{1}{4}$	15° approach angle, 10–15° rake in direction of swarf. Clearance angle 6°
2	5	150–175	0.010–0.020	$\frac{1}{4}$–$\frac{1}{2}$	"
3	5	80–110	0.025–0.035	$\frac{1}{8}$–$\frac{1}{4}$	0° rake angle, 10° approach angle, 6–8° clearance
	3	110–130	0.008–0.030	$\frac{1}{16}$–$\frac{3}{8}$	"
4	5	150–200	0.010–0.040	$\frac{1}{16}$–$\frac{1}{4}$	5° rake angle, 5° clearance

Cutting Fluid—Type 3, at 15 : 1. For finer cuts type 4 at 10 : 1 may be preferred.

High-Speed-Steel Tools (b)

Mat. Class	Speed, ft./min.	Feed, in./rev.	Depth of Cut, in.	Rake Angle
1	20–30	0.003–0.015	0.010–0.025	1–5°
2	30–40	0.002–0.020	0.005–0.035	4–8°
3	35–45	0.0015–0.030	0.005–0.040	5–15°
4	40–50	0.002–0.030	0.004–0.050	2–6°

Tool Material—Governed by considerations given in Table 2.

Cutting Fluid—Types 1 or 2, depending on severity of cut. Soluble oil, such as type 3 at 4 : 1 to 5 : 1, may be used, but tool life may be reduced about 20%.

Speed—For intermittent cutting the lower end of the speed range should be used. Under very good conditions of heat dispersal the values may be increased.

Tool Shape—Clearance angle should be sufficient to avoid fouling the work-piece plus 4–6°. In some profiling operations the total angle may be as high as 20–25°.

CONDITIONS FOR MILLING WITH H.S.S. TOOLS

Material Class	Speed, ft. min.	Tooth Load, in.
1	25–35	0.0015–0.004
2	25–35 (occasionally up to 40)	0.0015–0.006
3	35–45	0.001–0.008
4	40–50	0.001–0.010

Depth of Cut—Maximum possible.

Speed—The cutting speeds are only representative and vary considerably with the type of operation. For example, in rough profiling operations, where the amount of wear is not so critical and hand-feeds may be employed, the cutting speed for Class 1 materials may be as high as 50ft. min.

Cutting Fluid—Type 1 or 2, depending on the severity of cut. Soluble oil type 3 is used at about 4 : 1, but tool life may be lowered by 15–25%.

MACHINING CONDITIONS FOR DRILLING

Material Class	Speed ft. per min.	Feed, in. per rev.
1	20–25	Up to 0.0015in. for 0·1in. dia.; up to 0.006in. for ¼in. dia.
2	25–30	
3	30–35	0.0015in. up to 0·008in.
4	35–40	0.001in. up to 0·010in.

Cutting Fluid—Type 3 at 15 : 1 dilution for holes up to 7 or 8 diameters deep. Type 4 at 5 : 1 for deep holes which require the wetting agent.

Tool Material—Type 2 with lubricating surface treatment.

Helix Angle—35 deg. for Class 1, standard 28 deg. for Classes 2 to 4.

Point—Special, with four cutting edges for Classes 1 and 2. Standard 118 deg. point for Classes 3 and 4.

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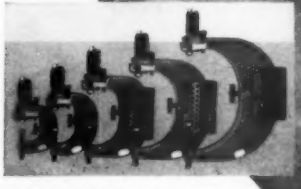

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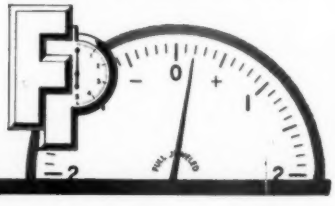

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Ruby and sapphire jewels—there are a minimum of 17 in a quality watch—are likely to scatter, and are so tiny that they are easily lost. To keep them together, a few drops of honey are poured into the little saucers in which they are kept.

No Polony

STATIC ELECTRICITY, the bugbear of so many industries, is particularly annoying in the watchmaking business where parts are microscopic in size. Engineers at Hamilton Watch have come up with a new idea that solved the problem for them, and may well have tremendous value in other industries. When static becomes troublesome, they take a tiny bit of Polonium on a wooden paddle and wave it over the bench. This ionizes the air and kills the static right away.

Polonium? That's one of the by-products of atomic research, but you don't have to be afraid of it; it won't "atomize" you.

$6400 Question

LAST YEAR, at the annual meeting of the Quarter Century Club of Doehler-Jarvis, Board Chairman H. H. Doehler began to talk about the necessity of obtaining higher productivity to attain a higher standard of living. As he talked, he warmed to his subject so enthusiastically that he raised his intended offer of a $64 prize to $6400 on the spur of the moment—to be given in parts or as a whole for increasing company casting production.

At this year's meeting, Harry Inselman, engineer in charge of Methods and Standards, received the award in toto. The same offer has been made for the coming year.

Goodbye Straight

JOHN S. COLEMAN, president of Burroughs Adding Machine, said recently: "In labor relations nowadays, we have learned that the shortest distance between two points is a curve."

In summarizing the computing-machine field, he said that 20% of the machines are desk types costing up to $600; another 10% robot machines costing $1 million or more; the remaining 70% are business machines not of the electronic type.

Daffynitions

WASHINGTON: where sound travels faster than light . . . YES-MAN: nodding acquaintance . . . ANGRY CUSTOMER: counterfeit . . . DIVORCE: struck union . . . BEAUTY CONTEST: lass roundup . . . RADIO: no-inch television . . . REARMAMENT: repairs for the Venus de Milo . . . PROGRESS: from dinosaur to Dinah Shore . . . FRENCH BATHING SUIT: costume cut down to see level . . . TWENTIETH CENTURY: Muddle ages . . . APIARY: where the best stings in life are free . . . SIXTEEN: age at which a lad turns from Boy Scouting to girl scouting . . . BIGAMIST: man who loves two well . . . GRAND CANYON: Gorgeous Gorge . . . MAO'S SPIES: Peiping toms.

Dumb Boss

A LOT OF MEN who complain about their boss being dumb would be out of a job if the boss was smarter —*Wall Street Journal.*

Robot's Robot

RECALLING the old English phrase, "a gentleman's gentleman," for a topnotch valet, is the recent development of a robot's robot. It seems that the big eniac machines (electronic calculators) are primarily suited to very complex problems. So they've developed, out at the University of California, a robot called Simple Simon. It can remember 16 numbers, provide a complex cube root, and the like—in contrast to the A T & T super-robot that can memorize 350 million numbers and work with them. Simple Simon is slower and less competent, but still pretty good, compared with anything except a Japanese with an abacus.

Hole in Hair

SOME YEARS AGO, one of the old-time workers at Hamilton Watch decided to test his skill by drilling a hole, crosswise, through a human hair. Later, Ripley (Believe It or Not) asked for a photograph. There wasn't one available, the sample had disappeared, and the man who had done it had retired. Not to be beat, however, another old-timer accepted the challenge. He made a 0.001-in. drill, stuck a 0.003-in.-dia hair in a piece of modeling clay, and drilled a hole right through the center. There's a lesson here for those who believe in compulsory retirement at 60, on the grounds that a man is then too old to do first-class work.

Vibration Treatment

WE HEAR, from an unimpeachable source, that aging of green castings may be unnecessary—if the "molecules are realigned" another way. One machinery builder, who uses castings that are large, thin-sectioned, yet must stay "on the nose," has developed a new stress-relieving trick. He balances the rough-machined casting on a crane sling, then goes from corner to corner, giving each extremity several quick taps with a block of wood or a soft-head hammer. This sets up vibrations that are supposed to realign the molecules just as aging does. Whether the theory is right or not, he's had no trouble with warpage on castings so treated.

News of Metalworking

McGraw-Hill WORLD NEWS

RUSSIA BUYS IN ITALY—The Genoese Company, "Ansaldo," will supply the USSR with 50 thermal-electric power stations of 500 kw each costing $130,000 each; 25 electric cranes of 5 tons each costing $51,000 each; and 20 other 7.5 electric cranes at $76,800 each. The articles will be shipped under the Italo-Soviet agreements of Dec., 1948.

CHINA ORDERS PLACED—Japanese Ministry of International Trade & Industry statistics reveal that Communist China placed orders for $640,000 worth of electrical equipment in Japan in January. Application for export of $410,000 worth of bicycles to Communist China was also received.

IMPORT DUTIES CUT—Diesel electric locomotives from British Preferential Tariff countries will now be admitted into Australia duty free and locomotives from other countries will pay 12½% duty. Similar concessions would apply to imported component parts for incorporation in main-line diesel-electric locomotives partly made in Australia.

AUTO PACT REACHED—Export prices in markets where Italian and French industries compete will be leveled. The agreement will apply especially to the automobile industries of the two countries, and eliminates the danger of a price war.

TRACTORS FOR YUGOSLAVIA—Under an agreement just made between a private Italian business mission and the Ministry of Foreign Trade of Yugoslavia, 350 tractors of 6½ tons each, and an unspecified number of motor buses for urban lines in Belgrade, will be supplied to that country.

BRITISH BUS IN U.S.—What is believed to be the first British-built bus to be supplied to a United States operator is the Leyland Tiger 40-seater, recently shipped from Liverpool for service with the Miami (Fla.) Transit Co.

OPS Pricing Regulation for Manufactured Goods Is Issued

WASHINGTON—At long last, the Office of Price Stabilization has whipped its manufactured goods regulation into shape.

In theory it is a simple order, having none of the fancy profit-limiting gimmicks that were once considered. It permits manufacturers to add to a base price—the highest charged in any calendar quarter of fiscal 1950—most of the increases in direct labor and material costs that have taken place since beginning of the Korean war.

The regulation offers manufacturers two optional methods of computing increased labor costs, four choices in computing higher costs of materials. A producer can decide to figure allowable cost increases, item by item, line by line, or for his business as a whole.

Cost increases that may be tacked on to base period prices have this big limitation: for domestically-produced commodities, only the rises that took place between June 25 and Dec. 31 can be reckoned; on imported materials, the cut-off date is April 1.

The order applies to all manufacturers except those who produce items covered by specially tailored regulations already put out by OPS or due out soon. Machinery, for example, isn't covered; it is being priced under a special order that has been drawn up along with the one for manufactured goods.

Machine Tool Builder, Distributor,

CHICAGO—The Washington situation as it affects machine tools was one of the two dominant themes of the 27th spring meeting of the American Machine Tool Distributors' Association at the Edgewater Beach Hotel, April 19-20.

Relationship of the builder and the distributor, and of the customer with the builder and distributor, was the other main topic.

An unexpected and dramatic interlude on the program of the first day was the televising of General MacArthur's speech before the joint meeting of Congress.

"You go down to Washington to discuss machine tool problems with defense agency officials and it is just as though you had under your arm The Thing." Lloyd McDonald, executive vice president, Warner & Swasey Co., and chairman, Government Relations Committee, National Machine Tool Builders' Association, declared. "No one wants them, and no one wishes to talk about them."

Mr. McDonald traced since Korea Washington's indifference toward the machine tool industry on four scores: (1) materials, (2) manpower, (3) money, (4) prices. He pointed out that the financial drain of expanding production had been so severe that many builders have almost run out of cash. That is why some builders have been asking for 25% advance on current quotations. Bank loans given builders on pool orders are ineligible for Federal Reserve discount, he said.

• **Distributors' commissions** are likely to be frozen where they are, not rising as increased prices are allowed for higher labor and materials costs, Mr. McDonald prophesied.

Large-swing lathes are needed in great numbers for the defense program, he declared. Washington has become aware of this necessity only in the past month.

Builders are cancelling subcontract arrangements as Washington becomes disinclined to allow for extra costs stemming from subcontract work. This action will be reflected in a dip in the volume of machine tool output within a few months, Mr. McDonald asserted.

• **What the machine tool builder** expects from the distributor was discussed at length by M. A. Hollengreen, president, Landis Tool Co. He pointed out the need for a strong, competent distributor organization to serve as the sales department for makers of standard general purpose machine tools because direct selling would be too expensive for many builders.

The need for the distributor to maintain a well-trained staff of sales

Firms That Don't Improve Products Irk Military

NEW YORK—Companies producing standard, unimproved items simply because they are tooled for these parts irk the military. Eventually the companies lose out because their competition, not tooled for the items, develop an improved product and get the next contract.

The statement was made by Capt. Carlyle L. Helber, Bureau of Aeronautics representive, New York Shipyard, speaking on "Performance vs Producibility" before the new Long Island Chapter No. 88 of ASTE at Garden City, N. Y., April 19. He stressed that the views were his, not the official opinion of the Navy.

The Long Island chapter was officially chartered last month, with Henry Maehl, of Fairchild Engine & Airplane Corp., Farmingdale, N. Y., elected chairman.

HOWARD W. DUNBAR (right), vice president of Norton Co., Worcester, Mass., received the Navy's Distinguished Public Service Award from Navy Secretary Francis P. Matthews at the Pentagon, April 10. The citation, in part, reads: ". . . during the period from June, 1940 to June, 1942 . . . Mr. Dunbar was of direct assistance to the Navy in obtaining machine tools for Naval Ordnance plants then being constructed, and in performing a major role in directing the retooling of American industry for war production he contributed significantly to the successful prosecution of World War II . . ."

Customer Relationship Theme of Dealer Meeting

engineers familiar with the machines made by the companies they represent was stressed, as was the need for the distributor to sell himself and his organization both to the builders he represents and to the machine tool buyers he serves.

George Habicht, Jr., chairman of the board, Marshall & Huschart Machinery Co., Chicago, presented an equally important paper on what the distributor expects from the builder of machine tools. He emphasized the joint responsibility of the distributor and the builder to make certain the distributor's salesmen know the product thoroughly. Mr. Habicht also discussed the need for the distributor to insure continuity of selling effort by bringing into his organization younger salesmen, and then training them to do an effective job of representing the machine tool builder within the distributor's territory.

• **Continuous top level contact** with his distributors is a must for the machine tool builder, according to Mr. Habicht. And the builder must fully understand the economic function of the distributor as the sales department of the machine tool industry.

Mr. Habicht also stressed the need for sales engineers sent out by builders to be able to live up to their titles. Each should be an expert on his machines, and should be able to answer any questions asked by customers or by distributors' salesmen, according to Mr. Habicht. In addition, these sales engineers should be able to make preliminary production estimates on the job and should be permitted to do so.

George P. Longabaugh, director, Headquarters Equipment Dept., Westinghouse Electric Corp., in discussing what the customer expects from the distributor and the builder, stressed the need for machine tool salesmen to be fully familiar with the machines they are selling and able to give clear-cut recommendations as to proper application of these machines. He also stressed the need for greater clarity and accuracy in the preparation of quotations, and urged the development of some standard form for writing these quotations.

• **Completeness of detail** in writing proposals should be a paramount rule, said Mr. Longabaugh, pointing out that proposals which do not specifically state what is offered, what the cost will be, and what delivery can be promised only serve to delay the work of the equipment engineer in making a selection of the machine to be purchased. He also pointed out the need for promptness in preparing proposals, particularly now when quick decisions must be made in setting up facilities for making weapons and other materiel needed for the defense program. Some builders, he said, have lost orders simply because their proposals were not received in time.

E. B. MacDonald of Syracuse Supply Co., and president of American Machine Tool Distributors' Association, presided at all of the meetings.

MAY MEETINGS

April 30-May 4—Materials Handling Exposition & Conference; International Amphitheater, Chicago.

May 3-4—Industrial Fasteners Institute; The Homestead, Hot Springs, Va.

May 14-16—Industrial Furnace Manufacturers Assn.; The Homestead, Hot Springs, Va.

May 23-24—American Society for Quality Control; Cleveland Public Auditorium.

May 28-June 8—1951 Canadian International Trade Fair; Exhibition Grounds, Toronto.

May 31-June 2—Machinery Dealers' National Association; Drake Hotel, Chicago.

CONTROLS . . . in brief

Materials Orders

COPPER: Relaxes restrictions against use of copper in parts. M-12 as amended (April 2).

LEAD: Controls tightened to stop further use of lead as substitute. M-38 as amended (April 3).

MAGNESIUM: Permits rescheduling of magnesium deliveries for military aircraft production. Suppl. 1 to NPA Delegation 1 as amended. (April 3).

COLUMBIUM-BEARING STEELS: Requires approval of aircraft production resources agency orders calling for columbium and columbium-tantalum-bearing steels for aircraft. M-3 as amended (April 6).

MOLYBDENUM: Established a broad allocation system to replace individual directives, effective after May 1. M-33 as amended (March 27). M-52 (March 31) limits amount of molybdenum in stainless steel to 2.5%.

NICKEL: Controls already in effect extended into the second quarter and additional products listed in which use of nickel is banned. M-14 as amended (March 31).

Price Orders

CONSUMER GOODS: Prescribes "historical percentage" markups for such consumer goods as musical instruments, radio and television sets, phonographs and records, housewares, silverware, jewelry, watches and clocks. CPR 7, Amendment 2 (April 5).

TUNGSTEN CONCENTRATES: Ceiling of $65 a ton set on sales and deliveries of tungsten concentrates. CPR 19 (April 6).

IRON & STEEL SCRAP: Order of Feb. 5 amended to increase the basing point prices for No. 1 heavy melting steel scrap at Detroit by $1.15 per gross ton, to bring the price into line with other areas. CPR 5, Amendment 1 (March 27).

Viscosity-index demonstration kit overcomes the deficiencies of the logarithmic ASTM viscosity-temperature charts in explaining to the layman the marked influence of temperature on viscosity. **Falling balls** demonstrate relative fluidity of oil samples

Kit Proves Superiority of High Viscosity Oils

NEW YORK—Industrial users can now obtain visual proof that oils offered to them will not thin out or thicken excessively over wide temperature ranges. Anthony J. Zino, Jr., assistant to the president, Swan-Finch Oil Corp., has devised a kit that proves the superiority of oils with a high viscosity index as opposed to low V.I. oils.

Until now the purchaser of engine, gear, hydraulic, turbine or spindle oils has had to rely upon the statements of salesman or the reputation of the supplier. And without means for appraising the "body" of oils at various temperatures, the buyer might balk at paying premium prices for high V.I. lubricants. Viscosity index is the relative ability of an oil to withstand temperature fluctuations without marked changes in flowing characteristics.

• **To demonstrate the fluidity** of oils at significant operating temperatures, Mr. Zino employed the principle of the falling-ball viscosimeter in making up his copyrighted kit. Four test tubes contain oils processed to represent the viscosities of an ordinary SAE 90 gear oil at temperatures of 30, 70, 100 and 210 F. An additional four test tubes are filled with oils processed to represent the viscosities of an SAE 90 gear oil of high V.I. at the same temperatures.

To compare the two oils at 30 F, the respective test tubes are inverted and the observer notes rates of fall of the steel balls contained in the tubes. In this case, the ball in the ordinary oil descends slowly, thus demonstrating that it will not flow properly to gears and bearings until warmed by service. On the other hand, the ball in the high V.I. oil descends rapidly, indicating that the oil will flow immediately when a cold start is made.

• **To find which oil is better** at 210 F, the respective samples are likewise inverted. Now, one sees that the ball in the ordinary oil falls the faster. Obviously, the ordinary oil thins out more at high operating temperatures and cannot supply as good lubrication as the high V.I. oil.

By these tests, the purchaser can observe for himself the importance of high V.I. oils in protecting all sorts of industrial and commercial equipment, without having to possess specialized knowledge of crudes and refining practices.

Plan Tank Research Center

DETROIT—After years of joint planning by the Automotive industry and the Ordnance Corps, a Tank-Automotive Research Center will be constructed at the Detroit Arsenal, Center Line, Mich. It will be located just west of the present Arsenal and just south of the General Motors Technical Center. Facilities will be available to industries engaged in defense work.

Are Roller Skates as Vital as Tools In Bid for Materials, Speaker Asks

PITTSBURGH—Machine tool builders, with a 22-month backlog of orders for machines vital to the defense program, are tied hand-and-foot by government policy and have no more standing in buying material than do manufacturers of roller skates and baby carriages, according to Tell Berna, general manager of the National Machine Tool Builder's Association, and one of the principal speakers at the 15th Annual Machine Tool Electrification Forum sponsored by Westinghouse Electric Corp.

Held here April 10 and 11, this meeting was attended by more than 300 engineers and executives from 129 companies.

• **"It was obvious** to the machine tool builders as soon as the Korean war broke out." said Mr. Berna, "that they would have to expand very drastically in order to meet the obvious needs of a defense program. It was also clear that the industry should immediately be given a blanket priority for needed materials, so that it might go to work and produce machine tools at a greater rate." The problems of the industry have been discussed with the heads of the government agencies concerned with war producion, but, according to Mr. Berna, "not one of these men displayed any great interest in the machine tool problem, and did not feel that any special steps should be taken to increase machine tool production."

The machine tool industry today, according to Mr. Berna, is in a ridiculous plight. "It cannot borrow money—it cannot write off investment in the period of the defense program if it uses its own money—it has no more standing in buying material than the manufacturer of roller skates and baby carriages—it is given help which it does not want instead of the help that it must have; giving a machine tool builder a pool contract is like handing a drowning man a towel. Finally, it is crippled by making its operations unprofitable so that they cannot be continued." Mr. Berna concluded by stating that "our defense program is merely conversation and dreams unless these machine tools (needed for the defense program) are quickly produced."

• **Herbert L. Tigges,** executive vice-president of Baker Bros., Inc., and consultant on machine tools, Machinery Div., National Production Authority, was another featured speaker at the forum. He outlined planning which led to the establishment of Metalworking Machinery Div. of NPA and discussed some of the problems involved in planning for a national defense program which is short of all-out war production scheduling.

Mr. Tigges stated that "for the present there is no answer to the problem of meeting defense production schedules except through controls and planned production of machine tools as set up in pool contracts."

J. J. Smith, Jr., Westinghouse, was general chairman of the forum, which was opened by F. D. Weatherholt, manager, Industrial Dept., Westinghouse Electric Corp. Members of the machine tool industry who presented technical papers during the forum included E. J. Rivoira, executive engineer, Cincinnati Milling Machine Co.; K. B. Rexford, supervisor of electrical design, Hydraulic Press Manufacturing Co.; J. J. Jaeger, assistant manager of engineering, Pratt & Whitney, Div. Niles-Bement-Pond Co.; and W. J. Stuebbe, chief electrician, G. A. Gray Co. Myron S. Curtis, director of engineering, Warner & Swasey Co., discussed the present need for conservation of manpower and materials.

Dexter M. Keezer, director, department of economics, McGraw-Hill Publishing Co., spoke on the current economic outlook for American business at the banquet Wednesday evening. Mr. Keezer discounted the possibility of a general war with Russia soon, but stressed the need for keeping at a high level the current defense production program.

Stove Firm to Make Fire Bombs

ST. LOUIS—A contract to produce napalm (fire) bombs has been awarded to American Stove Co., here by Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio.

Part of the stove firm's St. Louis factory is being converted to accommodate the contract. Production of gas ranges in this plant will continue in production at the maximum rate permitted by government regulations, the company announced.

PLANT EXPANSION NEWS

• **Reed Rolled Thread Die Co.,** Worcester, Mass., has begun construction on a new plant with improved facilities to handle the increased demand for thread rolling equipment.

• **Monarch Machine Tool Co.,** Sidney, Ohio, is modernizing 30,000 sq ft of existing plant facilities, and rushing construction of an additional 42,000 sq ft of new manufacturing and storage area.

• **Black & Decker Mfg. Co.,** Towson, Md., has broken ground for a new 100,000 sq ft branch plant at Hampstead, Md., to be in operation by early spring of 1952.

• **Commercial Shearing & Stamping Co.,** Youngstown, Ohio, has purchased a 20-acre tract at Salt Lake City, Utah, site of a proposed $1 million fabricating plant. Construction will start in May, with production under way this summer.

• **Air Reduction Co., Inc.,** New York, will construct a new calcium carbide plant costing upwards of $10 million at Calvert City, near Paducah, Ky.

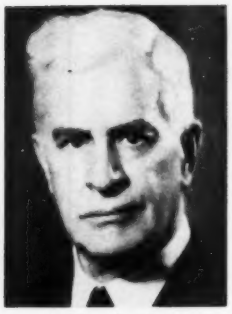
• **J. J. Tourek Mfg. Co.,** Chicago, has started construction on a new 60,000 sq ft plant at 1901 South Kilbourn Avenue to expand production of the firm's precision screw machine products, ball joints, and pipe plugs.

• **Timken Roller Bearing Co.,** Canton, Ohio, plans a $5,503,000 expansion program, involving both melting and fabricating facilities, at the Harrison Avenue plant. This will increase Timken's capacity for producing electric furnace steel by some 277,000 ingot tons annually and will raise the total steelmaking capacity from 550,000 ingot tons to some 625,000 ingot tons annually.

• **Cleveland Graphite Bronze Co.** is beginning a long-range program to expand production capacity by at least 50%, through establishment of five new branch plants. Capital expenditures contemplated are about $3,250,000 for buildings and about $1,750,000 for equipment.

• **Minneapolis-Honeywell Regulator Co.** has expanded its industrial production and operating facilities in Philadelphia through purchase of the Thomas M. Royal plant and acquisition of about 60,000 sq ft of adjacent undeveloped property.

Henry D. Sharpe, Jr.



Henry D. Sharpe, Sr.

Frank U. Hayes

Gordon Murphy

Names in the News

Henry D. Sharpe, Jr. has been named president of Brown & Sharpe Mfg. Co., Providence, R. I., succeeding his father who was elected chairman of the board. The new president joined the firm after three years of Navy service in World War II. He worked for several years in the plant to acquaint himself with details of production and operation. He was elected assistant secretary in 1948 and became a director in 1949. He was elected a vice president in November, 1950.

E. M. Heinmiller has been elected president of Fairfield Mfg. Co., Lafayette, Ind., succeeding **A. J. McAllister,** retired. Mr. Heinmiller joined the firm in 1920 and has been treasurer since 1932, a position in which he continues to serve.

J. C. L. Brown has been named sales manager, Machinery Div., Gardner Machine Co., Beloit, Wis. He was formerly associated with Landis Tool Co., where he was in charge of distributor sales for the United States and Canada.

Frank U. Hayes, sales manager, Bullard Co., Bridgeport, Conn., has been elected vice president. He was elected to the board of directors in September, 1950. Mr. Hayes has been with the company for 16 years.

Richard R. Harvey has been named manager of abrasive grain sales by Electro-Refractories & Alloys Corp., Buffalo, N. Y.

Howard K. Suter, formerly with the aviation engineering and sales division of Western Gear Works, has been named plant manager of Rosan, Inc., South Gate, Calif.

Donald D. Tomkinson has been named executive vice president of Daco Machine & Tool Co., Brooklyn, N. Y. He was vice president and general manager of Perkin-Elmer Corp., Norwalk, Conn., for ten years, and previously was director of purchases for F. A. Smith Mfg. Co., Rochester, N. Y., and director of purchases, Pioneer Instrument Div. and Bendix Marine Products Div., Bendix Aviation Corp., for five years.

Gordon Murphy has been named vice president in charge of manufacturing, Precision Gear Div., Foote Bros. Gear & Machine Corp., Chicago. He joined the division in 1947 as manager of manufacturing, after being associated with Fairbanks, Morse & Co., in the Beloit plant.

Carlton R. Becker has been named western factory representative, Morse Chain Co., Detroit.

H. Glenn Bixby has been elected president and general manager of Ex-Cell-O Corp., Detroit, to succeed **Phil Huber** who was elected to the newly created position of chairman of the board of directors. Mr. Huber was elected president in 1937. Mr. Bixby, who joined the firm in 1928, served as vice president and treasurer from 1947 to 1951 and as secretary and treasurer from 1937 to 1947. **James K. Fulks** was elected to the newly created office of executive vice president. He served as vice president in charge of manufacturing from 1942 to 1951. **Milton B. Montgomery,** factory superintendent, succeeds Mr. Fulks as vice president in charge of manufacturing. **Earl E. Conlin** was elected secretary and treasurer.

J. C. L. Brown

Donald D. Tomkinson

H. Glenn Bixby

Phil Huber

C. W. Bliss

E. B. Gausby

Herbert H. Pease

Robert T. Frisbie

C. W. Bliss, formerly controller of Warner & Swasey Co., Cleveland, was elected treasurer. **Irving C. Bolton,** formerly treasurer, was elected financial vice president; **E. B. Gausby,** formerly assistant treasurer, was elected secretary and **Warner Seely,** formerly secretary, was elected vice president. Mr. Bliss joined the firm in 1942, and Mr. Gausby in 1928, both as special apprentices. Mr. Bolton and Mr. Seely have for many years served as officers of the company.

R. F. Merwin has been elected president and general manager of Eriez Mfg. Co., Erie, Pa., succeeding **O. F. Merwin,** Eriez founder, who was elected board chairman.

C. Edgar Smith, executive vice president, has been elected president of Towmotor Corp., Cleveland, succeeding **Lester M. Sears,** Towmotor founder, elected board chairman. Mr. Sears will remain active in the management. Mr. Smith joined Towmotor in 1941 as sales manager, was named vice president in 1943 and executive vice president in 1947. **Robert L. Fairbank,** for 18 years with Firestone Tire & Rubber Co., has joined the firm as sales manager.

L. E. Loshbough has been elected president of Federal Press Co., Elkhart, Ind., succeeding **J. E. Loshbough,** founder, who asked to be relieved of responsibilities of president to become vice president and secretary. Mr. L. E. Loshbough will also be general manager.

Fred Watkins has been named general sales manager, American Swiss File & Tool Co., Newark, N. J.

Robert T. Frisbie, first vice president of New Britain Machine Co., New Britain, Conn., has been elected president, succeeding **Herbert H. Pease** who will continue as board chairman. **Ralph S. Howe,** vice president, was elected executive vice president. **Julian C. Pease,** secretary, was elected a vice president and director, and **William J. Lofgren,** treasurer, was elected secretary and treasurer.

OBITUARIES

William A. Rose, 70, who retired in 1945 as president of Bassick Co., Bridgeport, Conn., subsidiary of Stewart-Warner Corp., died April 1. He was sales manager of the firm's automotive division in Chicago prior to his appointment as Bassick president in 1934.

John E. Doran, 57, vice president in charge of sales of G. A. Gray Co., Cincinnati, died March 31. He joined the firm in 1927, becoming sales manager in 1928. Previously he served with Cincinnati Gas & Electric Co. from 1920 to 1926 as distribution engineer, and in 1926 he organized a firm of consulting engineers.

Elliott D. Harrington, 54, recently appointed vice chairman and secretary of the Defense Projects and Priorities Committee of General Electric's Small & Medium Motor Div., Schenectady, died April 1. Before being named to the defense committee post in January, he had been manager, Induction Motor Sales.

S. Duncan Black, 67, president of Black & Decker Mfg. Co., Towson, Md., since he and **Alonzo G. Decker** founded the firm in 1910, died April 15. Mr. Black went to work at the age of 16 for Rowland Telegraphic Co., advancing eventually to factory superintendent. It was there that he met Mr. Decker.

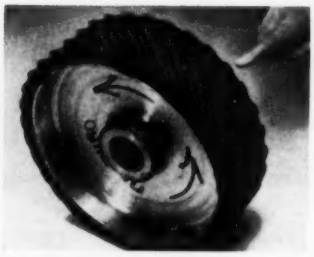
Lester M. Sears

C. Edgar Smith

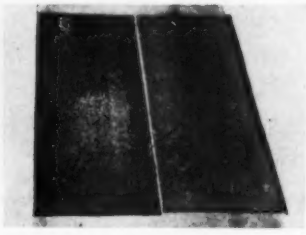
John E. Doran

S. Duncan Black

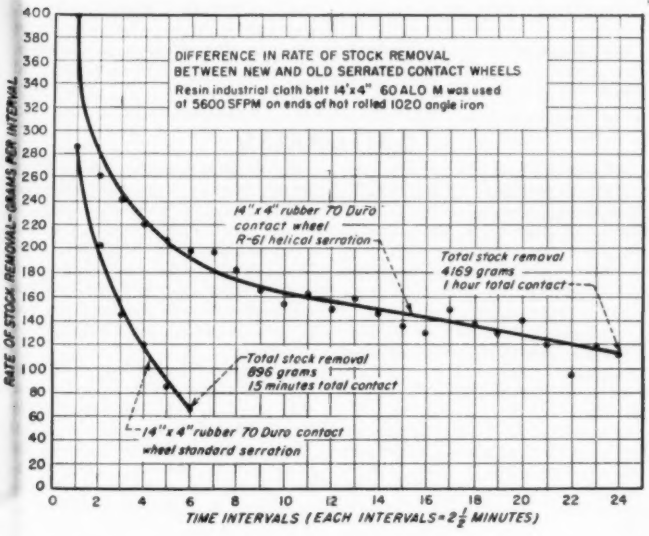
New Shop Equipment



Design of serrations resembles that of a milling cutter. The relief angle, wide-spaced lands, and narrowness of lands are responsible for the reduced wheel loading



Unglazed surface on section of abrasive belt at right is due to its being used with the "61" contact wheel. Belt was in operation 80 minutes; section at left 24 min. with a No. 50 Duro standard serrated wheel


DIFFERENCE IN RATE OF STOCK REMOVAL
BETWEEN NEW AND OLD SERRATED CONTACT WHEELS
Resin industrial cloth belt 14"x4" 60 ALO M was used at 5600 SFPM on ends of hot rolled 1020 angle iron
14"x4" rubber 70 Duro contact wheel R-61 helical serration
Total stock removal 4169 grams 1 hour total contact
Total stock removal 896 grams 15 minutes total contact
14"x4" rubber 70 Duro contact wheel standard serration
RATE OF STOCK REMOVAL-GRAMS PER INTERVAL
TIME INTERVALS (EACH INTERVALS=2½ MINUTES)
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400
0 2 4 6 8 10 12 14 16 18 20 22 24

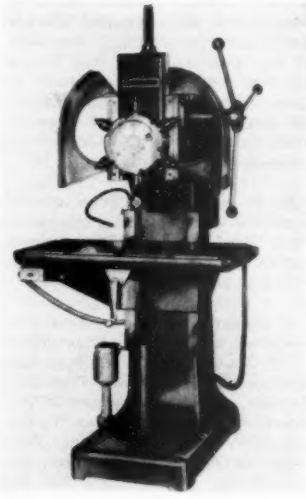
Serrated Rubber Contact Wheel Doubles Abrasive-Belt Life

The "61" backstand idler wheel is claimed to double belt life in operations where glazing normally occurs. It is also said to permit a greater and more constant rate of cut over the life of the belt, increasing production and improving the finish of the work.

The idea of a serrated rubber contact wheel is not new. By changing the design of the serrations, however, this contact wheel is said to cause a controlled breakdown in the bond of the belt. The successive "bumping" of the lands against the work constantly exposes fresh abrasive. The chips produced are longer than those made when using ordinary wheels because of the milling-cutter action of the lands. The chips flow backward from the work into the grooves and then pass under the work. This appears to be the reason for less glazing.

In a recent test, the "61" wheel was applied in the flat-surface grinding of auto bumpers prior to forming. Hill-Acme Co. surface grinders with 30-in.-wide belts were used. Previously, 300 pieces per belt were obtained. With the new wheel, this was upped to 600, with an increase of 128% in stock removal. Rejects were decreased and a more consistent finish realized.

The Carborundum Co., Niagara Falls, N. Y.



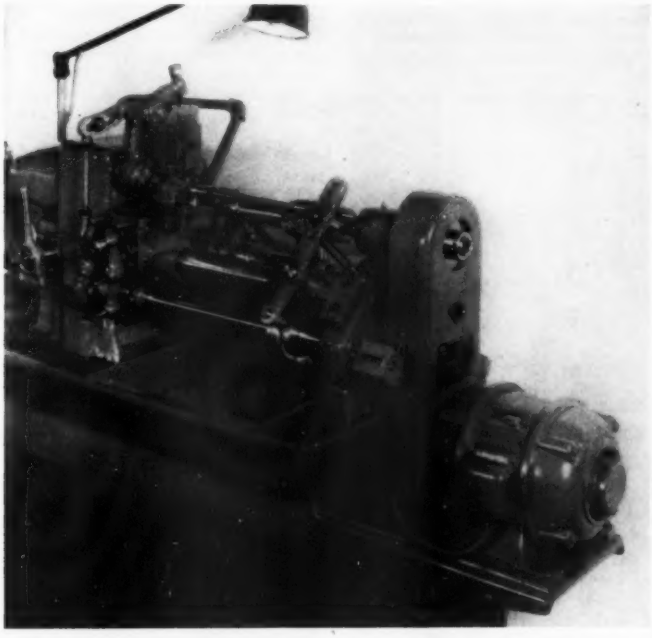
Burgmaster 6-Spindle Driller Has Automatic Power Index

The No. 2 Model A drilling and tapping machine has new features which are said to increase its speed and accuracy,

The improvements are: Power index from one spindle to another with preselective spindle speeds in a wide range; ¾-in. capacity in steel; heavy-duty tapping head; 8-in stroke; heavy, one-piece column; 17x33-in. worktable; 11¼-in. throat depth; spindles on tapered adjustable roller bearings; totally enclosed gearbox, running in oil; and a sensitive feed mechanism.

Burg Tool Mfg. Co., Dept. AM, 3743 Durango Ave., Los Angeles 34, Calif.

Materials and Parts



Tools and Cams Readily Changed On Traub Single-Spindle Automatic

The Traub automatic, German made, is built of simple and accessible units, making it easy to change tools and cams for short runs.

Built in four sizes, the model A-15 is the smallest with 19/32-in. maximum collet capacity and spindle speeds up to 6500 rpm. The A-20 has max. collet capacity of 13/16 in. and max. spindle speed of 4000 rpm. Model A-25 has max. collet capacity of 1 in. and spindle speeds to 4000 rpm. The largest model, the A-36, has spindle speeds to 2500 rpm and collet capacity to 1 13/32 in. The two smaller models use standard Brown & Sharpe collets, the larger, standard Traub-Index collets.

The main spindle is supported in angular-contact ball bearings. Any play can be eliminated with proper adjustment. It is driven by V-belts over a jackshaft from a 3-phase, 2-speed motor that provides 12 spindle speeds in all models.

The tailstock has a detachable quill to receive a collet for chucking drills, counterbores, box-tool holders, and similar tools.

A separate motor drives all cam shafts. Individual feed cams operate the slides. A built-in change-gear unit allows variations of the production rate from 38 to 2400 pieces per hour on Models A-15, A-20, and A-25, and from 20 to 1300 pieces per hour on Model A-36.

Feed can be stopped at any point in the cycle by means of an adjustable friction clutch. The clutch is built into the worm-gear drive of the feed mechanism. A detachable hand crank permits easy setup.

The bar is fed into the spindle from a feed tube by means of a weight-operated plunger with five plunger head. This method allows extremely long pieces to be fed.

Special Attachments

A longitudinal turning attachment is used for single-point turning of

...INCLUDING

Jig borer has head, cross rail, and smaller column rigidly locked by electromagnets page 140

Automatic cutting machine is sequence timed, so that cycle needs no adjustment page 141

Iron-Hand press unloaders have six jaw designs which enable them to handle any job page 142

Movable gantry for submerged-melt welding has electrical units in column page 144

Hydraulic guillotine cuts bars with 60,000-lb thrust and weighs only 38 lb page 146

Sheet-steel leveler employs double-tilt rollers. Unit can be reversed without readjustment and entry marks are eliminated page 148

Bar-cutting machine performs complete cutting cycle and retraction of head automatically page 154

Diamond in wheel dresser indexes through 7 stations, increasing diamond life page 152

...and in May 14

Gear hobber cuts gears with straight teeth, gears with teeth inclined to 18°, worm wheels, and bevel gears with straight teeth.

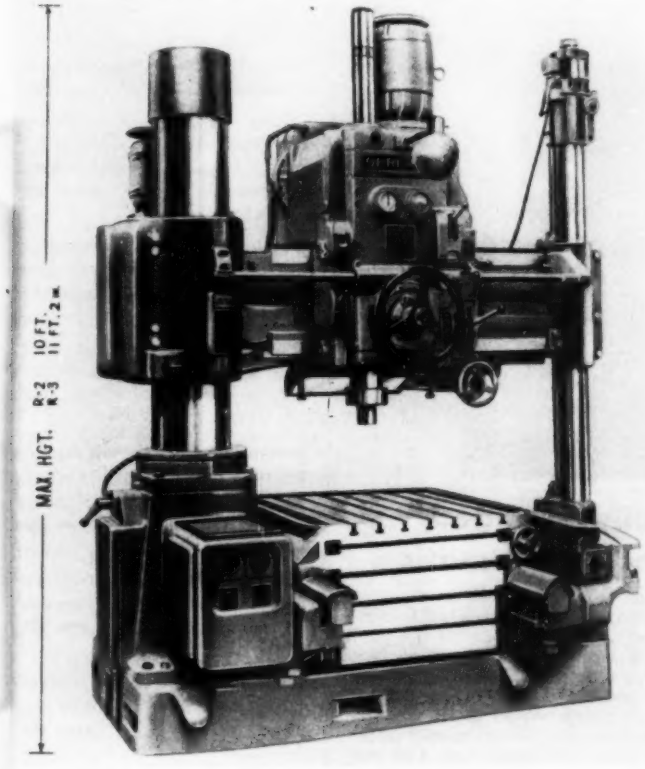
Motor-driven hydraulic press is double acting and has 8-in. of throat with a 12-in. ram travel.

cylindrical and tapered surfaces to 2 or 3⅛ in., depending upon material, shape, and diameter of part. It consists of a compound support which is mounted on top of the front slide by means of dovetail slides with adjustable gibs. It is fed longitudinally through a ball-jointed connecting rod from the tailstock, where it is operated by a drum cam.

A unique double-drilling attachment is employed in making stepped holes. It consists of a swinging body with two drilling spindles which are brought consecutively on center by a cam mounted on the front cam shaft. The cam operates each spindle to a maximum drilling depth of 1 in., which is controlled by adjusting screws on the drill holders.

Among other attachments is a magazine feed used for secondary operations. The parts can either be inserted manually or through a hopper for automatic operation depending upon the part.

E. R. Bachmann Corp., 130 W. 42nd St., New York 18, N. Y.



Head, Cross Rail, and Column Locked by Magnets on Jig Borer

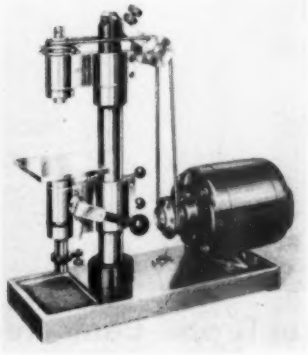
These jig borers are designed so that the boring head, cross rail, and smaller column can be rigidly locked in any position by electromagnets controlled through a single switch. They can also be mechanically locked or released independently of each other. It is claimed the rigid frame created makes it possible to locate holes by the coordinate method, using gage blocks or pins, to a tolerance of 0.0004 to 0.0008 in. between centers and to drill holes as small as 0.040 in. in diameter.

Known as the Oerlikon R-2 and R-3, the machines have 18 spindle speeds and 12 feeds. The R-2 has speeds from 38 to 1900 rpm, and feeds from 0.0012 to 0.031 ipr; the R-3 has speeds from 30 to 1500 rpm and feeds from 0.0012 to 0.0472 ipr. The motor on the boring head of the R-2 is 6 hp.; on the Model R-3, 7.5 hp. The smaller column at the extreme end of the cross rail rides over a wide arc.

Additional features include: fast mechanical return of spindle in addition to hand-operation; an automatic feed for setting depth of holes up to 14½ in.; a tool ejector bar inside the boring spindle; graduated scales with vernier readings to 0.0008 in. on ways of boring slide and work table, and operating controls located on boring head.

The Model R-2 has clearance between columns of 58⅝ in., maximum distance between spindle and work table 27 9/16 in., horizontal travel of boring head on cross rail of 25 19/32 in., capacity for drilling steel 1¾ in. diameter, for cast iron 2 3/16 in. The Model R-3 has greater clearances and capacities.

The Cosa Corp., 405 Lexington Ave., New York 17, N. Y.



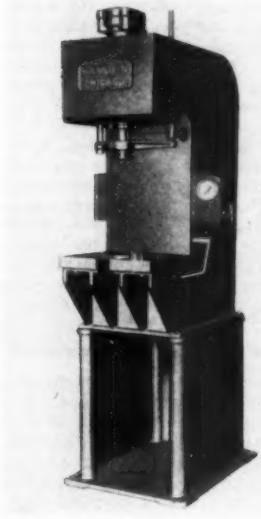
Special Drillpress and Collets For Small-Hole Drilling

In order to have drills run true, this drillpress is designed so that the spindle holds collets of the same type as that used in jewelers lathes. Thus drills as small as 0.002 in. in diameter can be held in a proper size collet. The collets used are stocked in sizes from 0.1 mm (0.004 in.) to 1.0 mm in increments of 0.05 mm and from 1.1 mm to 5.0 mm (0.197 in.) in increments of 0.1 mm. For special work, collets are also available in sizes up to 6.4 mm. (¼ in.) in increments of 0.1 mm but with a hole depth of only ¾ in.

The work is fed to the drill by raising the table, thus eliminating the drag caused by the conventional splined spindle. The table ram is made of hardened alloy steel and slides into hardened and lapped steel sleeves. A guide at the edge of the table, operating in a hard steel bushing, is used to avoid axial play in the table. The spindle is mounted

in pre-loaded ball bearings. A 1/20-hp motor supplies power. Spindle speeds of 1000, 1750, and 3000 rpm are available. Maximum travel of table is 1½ in. and the greatest distance between table and spindle is 4 in.

Louis Levin & Son, Inc., 782 E. Pico Blvd., Los Angeles 21, Calif.



Line of Small Hydraulic Presses Add 5- and 8-Ton Models

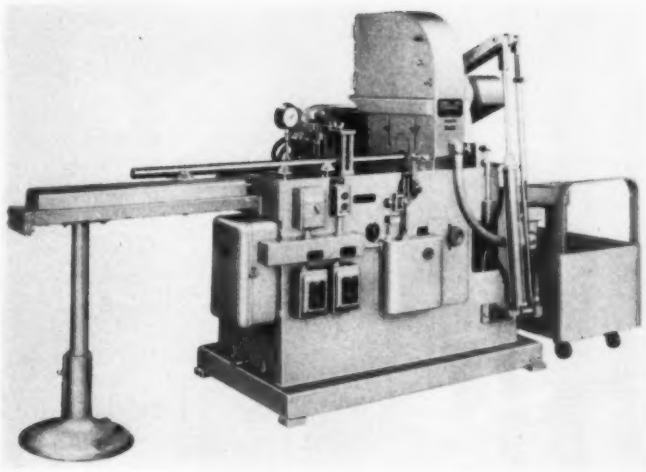
With these units, Hannifin has a complete line of small hydraulic presses ranging from 1 to 10 tons. Designated as the F-50A (5 ton) and the F-80 (8 ton), they can be equipped with larger pump and motor and consequently higher ram speeds. They are then called the F-51 and the F-81.

Model No.	F-50A	F-51	F-80	F-81
Capacity, tons	5	5	8	8
Stroke, in. (max.)	10	10	10	10
Gap, in.	16	16	16	16
Reach, in.	7.5	7.5	7.5	7.5
Ram Speed ipm (Down)	120	192	73	115
(1200 rpm motor) (Up)	240	390	151	242

Still higher ram speeds than those shown in the table can be furnished when needed. Single manual lever control is standard, but dual manual levers and electric push-button control are both available.

A feature that is desirable for repetitive operations is a stroke that can be shortened, by limiting the return stroke a point can be reached where the ram just clears the work. Also, the ram pressure can be adjusted to anywhere in a range between 10 and 100% of capacity.

Hannifin Corp., Chicago, Ill.



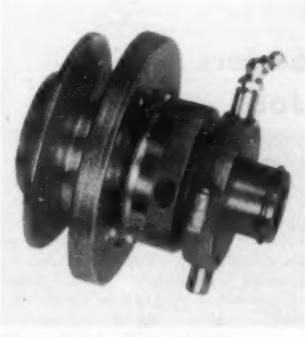
Fully Automatic Wet-Abrasive Cutting Machine

Every operation of this machine: stock feed, clamping, wheel feed, adjustment for wheel wear, and ejection of cut pieces, is completely automatic. Because the unit is sequence timed, no adjustment of the time cycle is required, regardless of the size of stock being cut or the length of the feed up to 12 in.

Here is how it operates: Abrasive wheel cuts through work. During this time the feed carriage is being returned to starting position. At completion of cut, abrasive wheel lifts to up position. Bar clamp is closed, clamping work in feed carriage, then work clamp under wheel releases bar. Feed carriage is then moved to right against its stop. Work clamp at wheel grips stock, then bar clamp on feed carriage releases. Abrasive wheel is started downward for cut and cycle is repeated.

Known as the Model 270, the machine cuts up to 2-in.-dia solid annealed or unannealed steel and 3½-in.-dia tubing.

Campbell Machine Div., American Chain and Cable Co. Inc., Bridgeport 2, Conn.

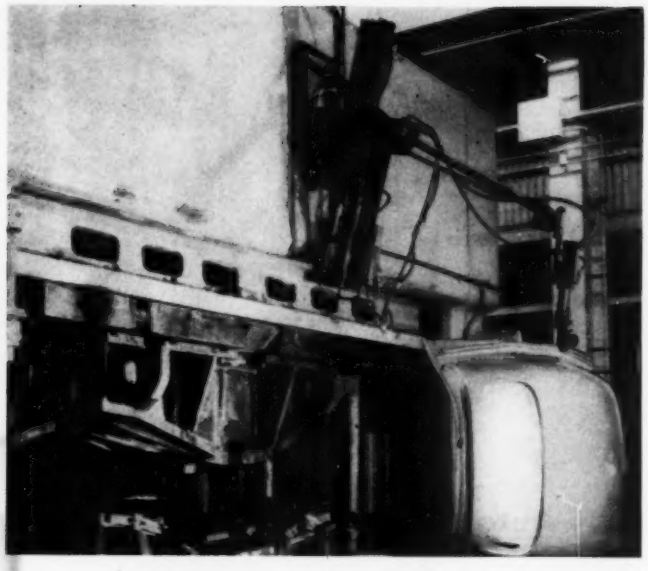


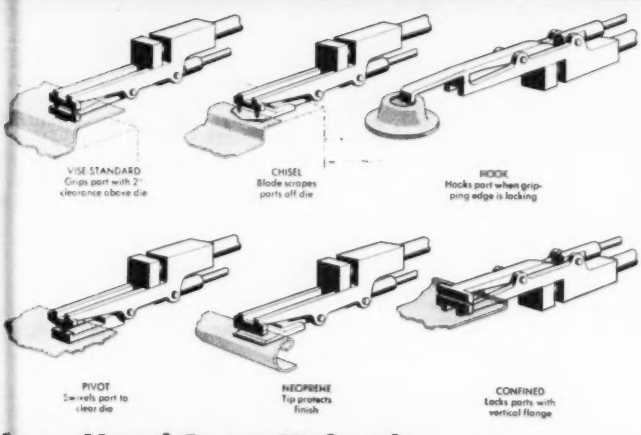
Edgemont Friction Clutches Have Integral V-Belt Pulley

Series of disk friction clutches for stub or through shaft mounting is suitable for gasoline or electric motors, speed reducers, and auxiliary shafts. Known as Type K, they are available from stock with one or two-groove pulleys in either 3⅜ or 3¾ in. OD. The K-S clutch is furnished for use with plate-type sprocket when the clutch application requires only short idling periods. The K-E clutch has split friction disks, and is built in two variations: cut-off coupling for connection and control of two aligned shafts, or extended sleeve for mounting pulleys, sprockets, gears, in through shaft applications.

The clutches are manually operated, engaging and disengaging with light pressure, and picking up the load without grab. A threaded steel adjuster allows settings to yield maximum pulley power with minimum engaging pressure required. It can be clamped at desired point.

The Edgemont Machine Co., 2200 Home Ave., Dayton 1, Ohio.





Iron-Hand Press Unloaders Have Jaw to Fit the Job

Six jaw designs have been developed by Sahlin for the Iron Hand that enable the unloader to handle any unloading condition. The first two, the "cat's paw" and the "chisel," are applicable to 90% of the stampings which are unloaded automatically.

The "cat's paw" jaw is recommended for panels having a minimum of 2 in. clearance from the lower die—in the case of drawn stampings, those which are lifted 2 in. or more above the draw ring. It has 4 vise grippers, two each on upper and lower jaw sections.

The "chisel" jaw is used to pick up stampings that are not lifted off the lower die. The lower jaw member is a chisel blade which scrapes the panel from the die surface. The upper jaw has 2 cone-point grippers. A feature is its ability to lift stampings vertically any distance before swinging out. It can also be used for stampings which are lifted off the die.

The "hook" jaw is for stampings which lack gripping surface but have a hole or pierced section which can be employed to lift it out of the die. The lower jaw assembly is specially designed to suit the panel to be removed.

The "neoprene" jaw is used to unload finished stampings which must be free of all abrasions and indentations. It is used with a specially designed lower jaw which confines the stampings rather than grips it.

The "confined" jaw is used to remove stampings with a vertical flange. Designed to the dimensions of the flange, it confines the stamping inside the jaws rather than gripping it, thus preventing the flange being crushed or the stamping marked. It is applicable only where the stamping is lifted at least 2 in. off the lower die surface.

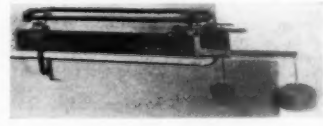
The "pivot" jaw is required to unload stampings where die clearance is facilitated by pivoting the panel free. This is the case in certain auto front-fender press and die setups. Pivoting is also desirable where there are succeeding operations. The jaw has a single cone-point gripper on each of the upper and lower jaws.

Stroke and Time Improvements

The jaw assembly has been changed to permit a longer stroke and reach into the die: (*AM*—Oct. 2, 1950, p 142). An extreme case is an installation in a Chrysler plant of an Iron Hand with a 5-ft reach to extract a large fender from a deep-bed Hamilton press.

The cycle time has been increased from a maximum of 20 to 28-30 a minute, which generally exceeds the speed of straight-side forming presses. This was accomplished through redesign of airline connections and cylinders. A new cam assembly minimizes vibration and provides a rigid mounting.

Sahlin Engineering Co., 267 Ferndale St., Birmingham, Mich.



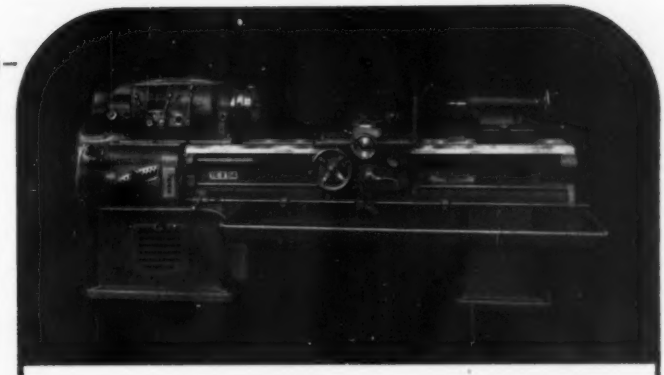
V-Belt Matching Machine

The Flexoid is a portable unit for matching V-belts to make up equal length sets for smoother operation. The unit has a capacity for A, B, C, No. 4L and No. 5L V-belts up to 210 in. in length.

The belt is placed on the two sheaves and the weighted arm released. The lengths of the belt for the pre-determined load on the arm is then read on a scale.

The Smith Power Transmission Co., 1545 E. 23rd St., Cleveland 14, Ohio.

Standard Model—



MODERN Hendey

16", 18-speed engine lathes – for precision turning

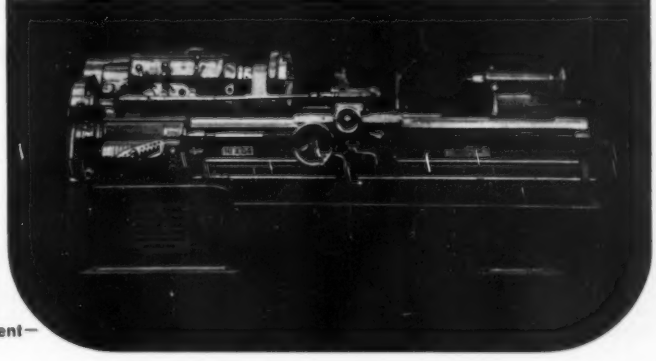
FEATURING induction hardened and ground precision bed ways

PLUS—

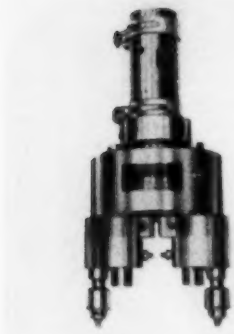
18-Speed Sealed Precision Geared Head.
Quick Change Gear Box Mechanically Oiled.
36 Thread Cutting and Feed Changes.
1½ to 80 Threads—.003 to .1666 Feeds.
Alloy Steel Gears in Headstock.
Gears Refinished After Heat Treatment.
Gear Shafts Mounted in Anti-Friction Bearings.
Anti-Friction Spindle Bearings Double Opposed, Pre-loaded.
Spindle End Indexed for Multiple Thread Cutting Without Disturbing Gear Train.
Apron and Carriage, Automatically Lubricated.
Quick Acting Levers Operate Longitudinal and Cross Feeds.
Feed and Split-nut Levers Interlocking and Fool Proof.
Quick Withdrawing Attachment for Threading.
Large Hole thru Spindle Accommodating Large Collet Capacity.
Spindle Nose Optional; Flanged Type Cam Locking, Long-taper Type Key Driven, Hendey Standard Threaded Nose.
Lathe Equipped with the New High Speed Apron Reverse for Lead Screw.
New Feed Dials, Large, Accurate and Quick Reading.
Micrometer Carriage Stop; Automatic Longitudinal Stops in Either Direction of Travel.
New Positive Cross Slide Stop.
New Re-inforced Bed Brackets with Anti-friction Bearing for Tail End of Lead Screw.
Special Clamping Device for Tailstock.

Every feature necessary for precision turning at modern production speeds is incorporated in the 16-inch, 18-speed Hendey engine lathe—in other words, *Built to Hendey's Modern Precision Standards.* The operator will find every convenience—from easy-operating controls to features that practically eliminate maintenance. Induction hardened and precision ground bed ways provide life-long precision for both carriage and tailstock. This modern Hendey Tool Room Lathe is available in standard and tool room models. The latter is shown below with sub-headstock for producing threads with long leads. *Write for catalog.*

THE HENDEY MACHINE COMPANY
MAIN OFFICE & PLANT: TORRINGTON, CONN.
BRANCH OFFICES: New York, Chicago, Boston, Detroit, Rochester, Los Angeles, San Francisco
REPRESENTATIVES: Philadelphia, Cleveland, Pittsburgh



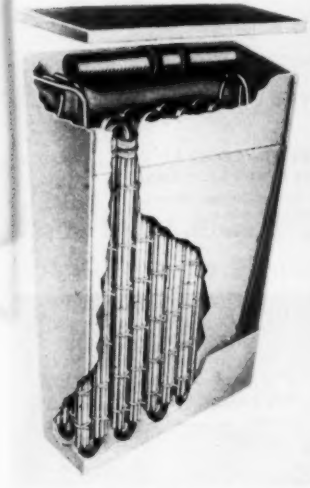
Tool Room Model with sub-headstock & relieving attachment—



Driving and Reversing Gears Built into Tapping Head

Gearing is built into the adjustable head of this unit, making a shorter and more compact device. The head is sealed in a cast-aluminum case with Alemite fittings for pressure lubrication. All bearings are either hard bronze, ball, or needle. Gears and spindles are one piece, turned from bar stock and heat-treated. Two sizes are available with $\frac{1}{4}$- and $\frac{1}{2}$-in. tap capacity in 2, 3, 4, and 6 spindles.

Errington Mechanical Laboratory, Inc., Staten Island 4, N. Y.



Cooler Controls Temp. of all Oils Used by Machine Tools

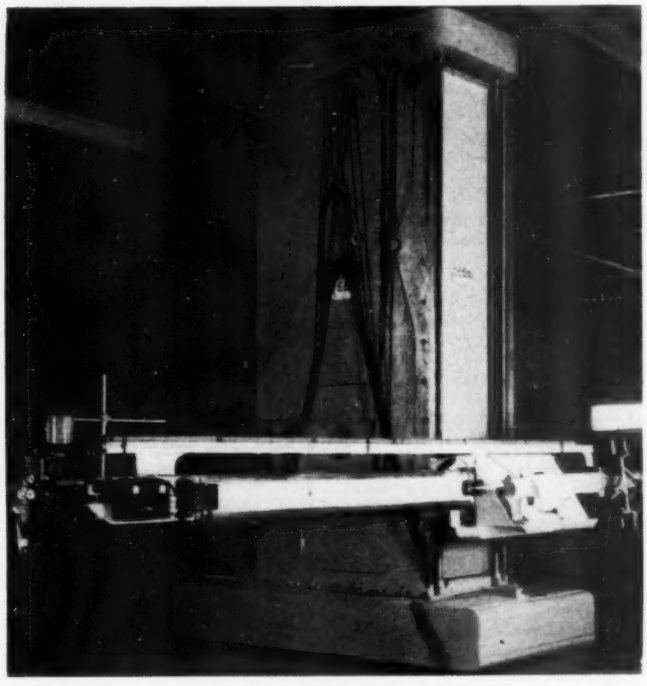
Control of the temperature of the cutting oil or coolant, lubricating oil, or hydraulic oil can be accomplished by this cooler. Any two can be handled simultaneously by adding cooling and interchanger surfaces to the basic unit. Advantages claimed include: more uniform workpieces, uniform oil viscosity, longer tool life, cooler workpieces, and a reduction in oil evaporation.

How it works (cutting-oil application): Oil from the sump in the machine tool is continuously pumped through an oil line to the top trough of the cooler. Here it flows by gravity through a metering device and then over both sides of multi-V finned tubes. Inside the tubes are the pipes carrying the refrigerant (Freon-F12). After cooling it passes back to the sump. A thermostat in the cooler controls the starting and stopping of the system.

An important feature of any cooler of cutting oils is how easy it is to clean out. The Will-Cool unit can be inspected and cleaned without the necessity of disconnecting refrigerant or oil lines. Accumulation of fine metal particles is restricted to a non-cooling surface where they can be seen and removed.

The cooler can be employed with or without a condensing unit. Sizes available range from $1\frac{1}{2}$ to $7\frac{1}{2}$ tons.

B. S. Williams Co., Inc., 6 North St., Mt. Vernon 1, N. Y.



Reed Movable Gantry For Submerged-Melt Welding

The welding generator or transformer and flux-recovery unit are installed within the gantry column in this unit, leaving only the electrical power supply to be brought in through drag cables or trolley bars.

The gantry moves on standard-gage railroad track through a variable-speed range from 5 to 320 ipm. The welding boom, which mounts any standard automatic-welding head, is powered for vertical adjustment up to 12 ft. The boom is retracted through a variable-speed power source, permitting welding of 10-ft seams at right angles to the gantry track. Dual controls permit operation from either the end of the welding boom or from the base of the gantry.

Variable-speed turning rolls are available to handle vessels up to 100 ft in length.

Reed Engineering Co., 1003-17 W. Fairview Ave., Carthage, Mo.

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Chicago	Houston†	Newark	Rochester†	office only)
Cincinnati	Indianapolis	New Orleans	St. Louis	

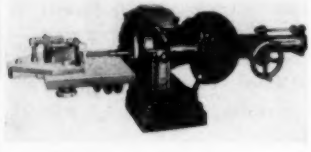
Manco Hydraulic Guillotine Cuts Bars with 60,000-Lb Thrust

The 20E hydraulic cutter cuts the larger diameters of rod, bar, chain, wire rope, and similar material. Only 2½ sec is required for the cutting cycle. The cutting-head unit weighs only 38 lb, making the tool portable.

Rod and bars up to 1 1/16 in. dia, wire rope up to 1¼ in., and power cable up to 3½ in., can be handled. The cutting head is connected by 25 ft of flexible hose to a high-speed hydraulic pump. The pump is powered by either a 2-hp electric motor or a portable gasoline engine. Pump and power unit can be dolly-mounted for complete mobility.

With the pump on, the operator closes the hand valve mounted on the cutting head, causing the cutter blade to make the cut with a 60,000-lb thrust. Release of the hand valve provides automatic blade retraction. Special oil seals prevent leakage at the 10,000 psi operating pressure. Reserve cutting heads can be coupled quickly in place when overhaul or blade sharpening is required.

Manco Mfg. Co., Bradley, Ill.



Hydraulic Boring Machine Works to ± 0.0003 Tolerance

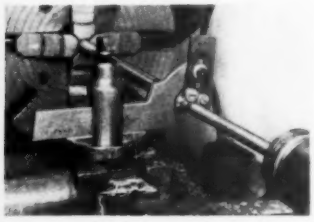
Precision and good finishes are claimed for this horizontal boring machine. Reasons given are: work is stationary and only the boring tool revolves; the surface to which the work fixtures mount is hand-scraped to 0.0003 of square and at 90° to the spindle; and the workholding fixtures can be mounted on the face and precision finished on the machine itself.

The feed mechanism consists of a threaded piston that rotates in a cylinder of oil. This oil chamber is self-contained and has no pump or separate oil supply. Oil transfers through the piston as it revolves, actuating the spindle into and through the work.

Spindle drive is provided by a ½-hp. motor with V-belt drive to multiple pulleys which provide shaft speeds of 460, 900, or 1400 rpm. Maximum feed is predetermined by lead and depth of thread on piston and is fixed at 0.004 in. although lesser feed can be obtained by controlling the by-pass valve used to put the feed in motion. The nose of the spindle is taper ground eccentric to the center of rotation which enables the operator to adjust the cutting tool a total of 0.014 in. by advancing the boring head clockwise in the spindle. The spindle has an identifying mark to give the operator a direct reading in thousandths of an inch. It is possible to increase the bore by as little as 0.0001 diameter.

The unit can be set to feed through work and remain in inactive position; feed to adjustable stops, and return automatically; or continue in a cycling operation, requiring only loading of the parts by the operator.

Hydro-Borer Co., Dept. A-47, 1511 W. Florence, Inglewood, Calif.



Dasso Followrest Tool Holder Eliminates Work Climbing

By using a slotted bar and rollers combined with a toolholder, this unit is said to eliminate chattering and climbing when machining long shafts. Setup time is shortened because steadyrests or machine followers are eliminated.

Illustration shows a tool-steel shaft, ⅞-in. dia x 30 in. long being reduced to a 9/16-in. dia in a single cut. Body of the holder measures ⅝ x 1⅜ x 6¾ in., and takes a ⅜-in. toolbit. Price—$14.50

Dasso Tool Products, Box 13, Lincoln Park, Mich.

Pads Changed on Collet Without Removing it from Spindle

Replaceable pads on the Style FL master collet are diamond serrated. They grip the work together; holding both horizontal and rotating thrust at an angle. Available for automatic screw machines, the tool handles all sizes and shapes of stock within capacity limits. Accuracy of taper and concentricity of hole and threads are claimed for the unit because of careful manufacture.

Sutton Tool Co., Sturgis, Mich.

They brought Paris to the oil fields

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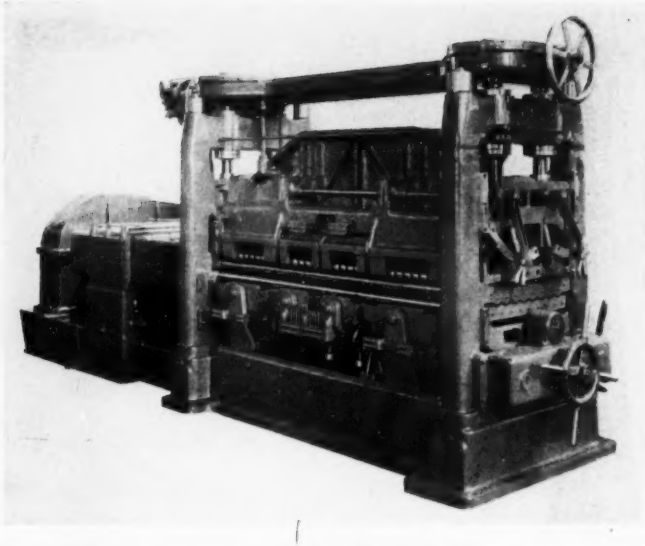


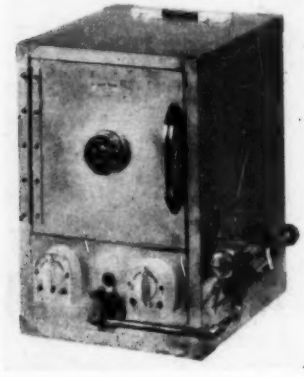
Leveler Has Double-Tilt Rollers

In the double-tilt leveler, the upper straightening roll bank is divided into three groups. The center group always remains in parallel with the lower straightening rolls. Therefore, the depths of the corrugations in this work area remain at a maximum and the stresses are well above the elastic limit of the material to be straightened. The entry and exit roll groups are symmetrically tilted toward the center group to subject the incoming sheet to gradually increasing wave depths and to flatten out the outgoing sheet, respectively.

The advantages claimed are: leveler may be instantly reversed without readjustment; work material is "sucked" into the machine without effort by the operator; entry marks are eliminated; only central roll group takes heavy work loads in area where universal joints and drive spindles have least angularity and maximum torque capacity; thorough "kneading" of the material eliminates subsequent stretch strains in deep-drawing operations; gradually increasing waves at entry side tend to stiffen material and minimize coil breaks.

The levelers are available with 17 and 23 rolls, for maximum sheet widths from 32 to 90 in., and max. sheet gage from 0.034 to 0.25 in.

Maust Machinery Corp., 85-36 212th St., Queens Village 8, L. I.

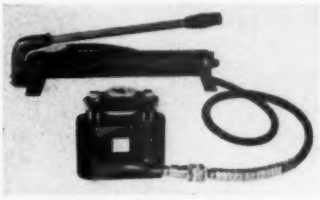


Gas-Fired Baking Oven For Temperature up to 650 F

Capacity of this small oven is 250 to 650 F. A pyrometer-actuated gas controller maintains constant temperatures at any setting. Insulation is 2 in. of Johns Manville Marinite. Two timers can be set for any time up to 60 min. The moving indicator shows the minutes remaining and a bell rings when time is up. Gas burner mounted under a thick steel baffle prevents impingement of flame with oven contents. Heating chamber is 10 in. wide, 9 in. high, and 12 in. deep with 2 shelves.

Some of the industrial uses for the oven are: baking or tempering small production orders; heating samples; precipitation hardening of beryllium-copper and other alloys; drying cores; baking molds and plastics; and other uses.

The Carlson Co., 277 Broadway, New York 7, N. Y.



Owatonna Hydraulic Puller Develops Force of 15 Tons

Weighing less than 10 lb and developing 15 tons, The Power-Twin has a center hole which makes it adoptable to all OTC systems now in use. Its twin cylinders and center hole are claimed to allow it to be used for jobs inaccessible with a hydraulic ram.

The puller is 5½ in. high, works in any position, and ram has 2-in. travel. The remote-control pump develops 10,000 psi. Wire guards protect the hose, and special non-leak couplers are tested for 24,000 lb.

Owatonna Tool Co., 383 Cedar St., Owatonna, Minn.

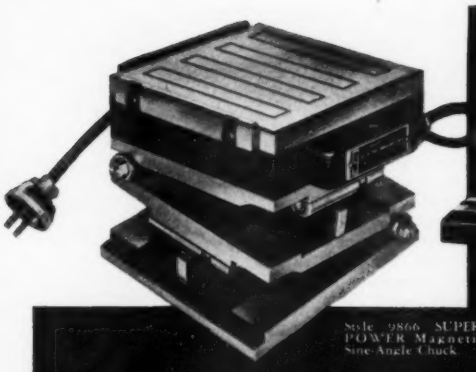
Chicago-Wheel Hand Grinder Operates at 20,000 rpm

The Hi-Power grinder spins at 20,000 rpm, and is dynamically and statically balanced. The motor is independently mounted and is thus easily detached from the tool.

Other features include an independent ball bearing spindle, lubricated for life, and a forced-air-ventilated hand piece. A universal Jacobs chuck with ¼-in. capacity permits the use of a 2-in. grinding wheel or any ¼- or ⅛-in. shank-mounted wheel.

Equipped with 8 accessories, including mounted wheels, sander, chuck key, and dressing stone. The unit comes in either of two models—No. 3500—110-120 v ac-dc, 25-60 cycle and No. 3505—220 v ac-dc, 26-60 cycle—both listing at $49.50.

Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Chicago 7, Ill.



Style 9866 SUPERPOWER Magnetic Sine-Angle Chuck.

Style 510 Swivel Base SUPERPOWER Magnetic Chuck.

7 REASONS WHY

You Can't Beat a T-P Chuck

Whether you buy one of Taft-Peirce's many standard models or have one custom-made — all T-P SUPERPOWER Magnetic Chucks offer you these 7 advantages:

1. More Holding Power — size for size
2. Faster Setups
3. Greater Working Surface
4. Low Magnetic Losses
5. Rugged, Rigid, One-Piece All-Steel Body
6. Waterproof and Shockproof Construction
7. Generous Safety Factors

Contact your local Taft-Peirce representative for more details. He'll be glad to help you select the chuck best suited to your needs.

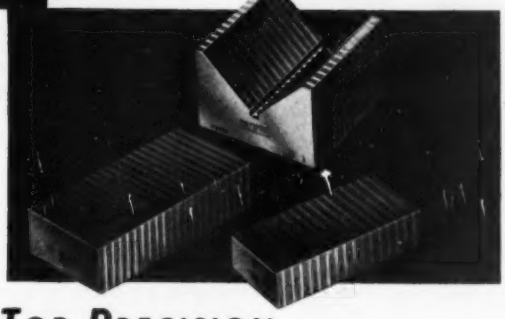
The Taft-Peirce Mfg. Co.

WOONSOCKET RHODE ISLAND

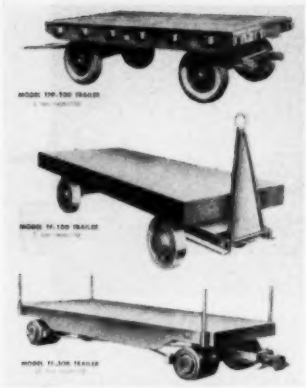
Left: Style 618 SUPERPOWER Magnetic Chuck.

Bottom Left: 16" SUPERPOWER Rotary Magnetic Chuck.

Below: SUPERPOWER Magnetic Parallels and V-Block.



TP means TOP PRECISION



Phillips Industrial Trailers Have All-Welded Construction

Capable of being used singly or in pairs, these trailers have an all-welded, heavy-gauge steel construction. All three models are available with a fifth wheel at both ends or at one end only. All wheels are Timken roller bearing equipped.

Model TPF-100 has a 5-ton capacity, 16-in.-dia pneumatic-tired wheels, 40½-in. clearance, and stake pockets.

Also of 5-ton capacity is the Model TF-100. It has solid rubber tires, stands less than 23 in. high, and has 4 stake holes on each side.

The Model TF-300 trailer has a 15-ton capacity, over-all height of less than 23 in., dual solid wheels, and a removable stake at each corner.

Phillips Mine & Mill Co., 2322 Jane St., Pittsburgh 3, Pa.

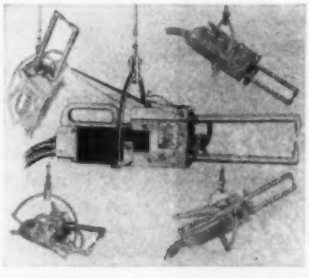
Lord Flexible Couplings Have Low-Cost Features

Hubs stamped from steel strip stock and the elimination of keying has reduced the manufacturing costs of these flexible couplings. They are for electric motors with ratings up to ½ hp at 1750 rpm accommodating shaft misalignments up to 2° angular and 1/32 in. parallel.

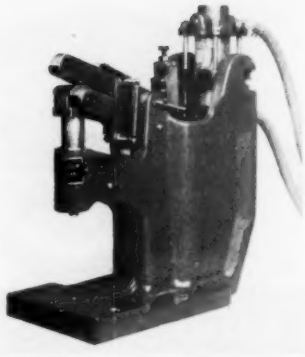
Oil-resistant Neoprene is bonded between the two flanged hubs to produce a one-piece design which is easier to handle and assemble into machines. Since the Neoprene is stressed in shear, maximum torsional flexibility is obtained.

The die-formed hubs are claimed to be held to a diameter tolerance of 0.002 in. One side of the hub is flat, resulting in a D-shaped bore which mates with the milled flats on both motor and driven shafts. Installation requires only that the coupling hubs be slid on. Because the shafts are free to move longitudinally, normal motor-shaft end play can be accommodated.

Lord Manufacturing Co., Erie, Pa.



SPOT WELDER equipped with ball-bearing suspension ring is shown in four positions illustrating the ease of operation. It weighs 80 lb, and has ratings of 10 and 20 kva.—*Miller Electric Mfg. Co., Appleton, Wis.*

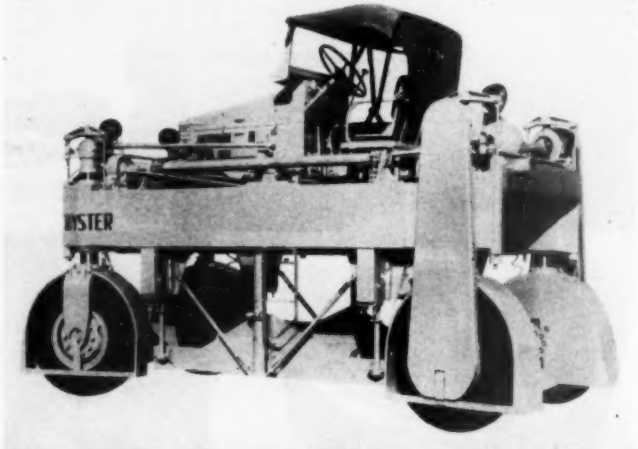


Spindle on Staking Machine Has Pad for Assemblying Part

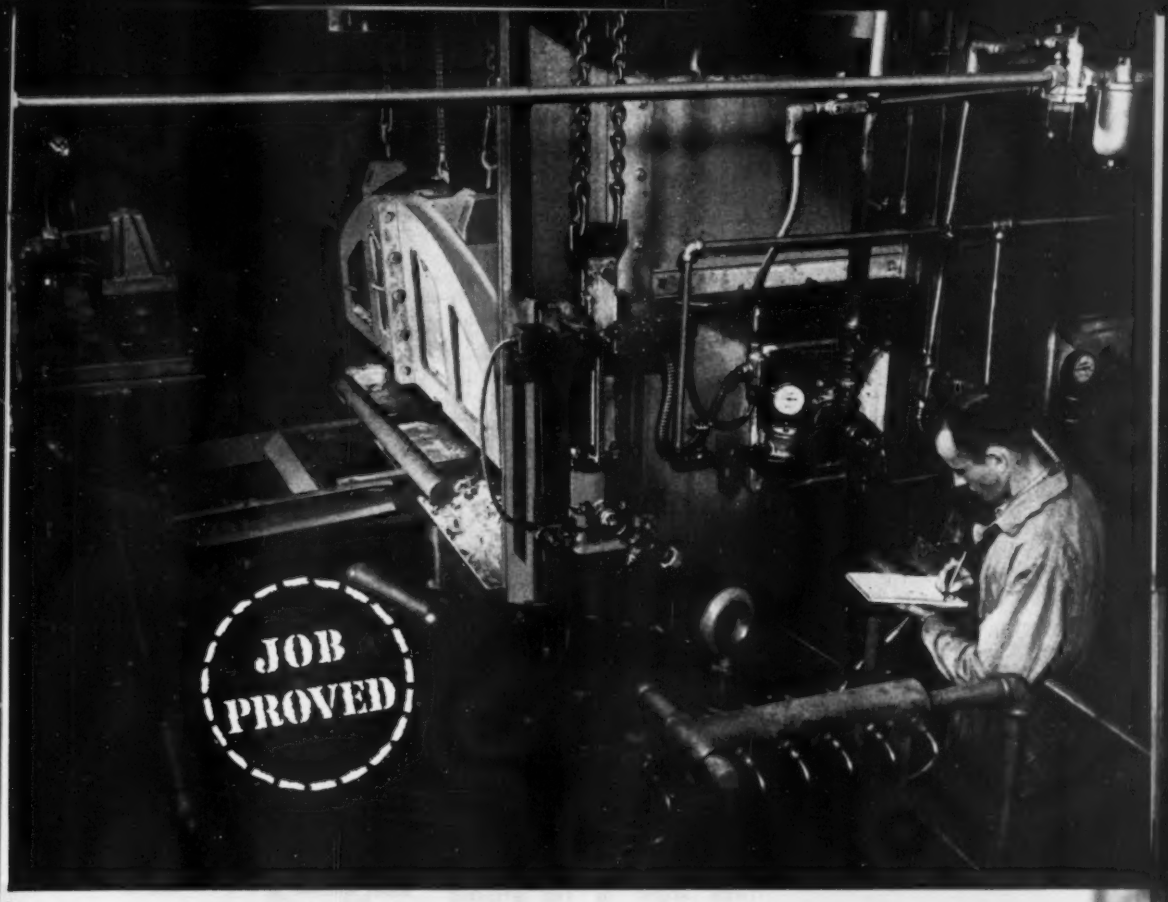
This machine is expressly designed for staking or riveting fixed or moveable joints, but it can also be used for eyeletting, inserting grommets, burring, and pointing with platinum, tungsten, or silver. The spindle is constructed with a pressure pad which compresses or assembles the work prior to staking.

The weight of the hammer blow is adjustable to suit the job. Trip-dog action is said to insure a uniform blow despite slight variations in stock thickness. The standard machine is furnished with an air foot switch, but dual hand controls can be furnished at extra cost.

The High Speed Hammer Co., Inc., Rochester, N. Y.



STRADDLE TRUCK, the model MHS, has double-row roller chains in the hoist mechanism, solid-bar rather than channel sections in the lifting links, additional carrying capacity in the suspension springs, and a heavier frame. Especially designed for handling steel, it has a capacity of 15 tons.—*Hyster Co., 2902 N. E Clackamas, Portland 8, Oregon*



HYDRAULIC SYSTEM KEPT LIKE NEW

Sunvis 916 Effects Substantial Savings; Strainers and Lines Kept Sludge-Free

A copper tubing manufacturer uses an oven with hydraulically operated doors to heat billets to approximately 1550F. The ambient temperatures around the hydraulic mechanism are abnormally high, putting the hydraulic fluid to a severe test of stability. Failure of the system would halt the piercing operation and result in costly delays throughout the plant.

Since the oven was first put in operation, three years ago, the hydraulic fluid has been Sunvis 916. The original charge has never been changed and is still in excellent condition, though the system is tight and requires only a minimum of make-up. Oil lines and strainers are completely free of sludge. Seals and packings are sound. Operations are never interrupted for oil changes or parts maintenance. The company expects to retain the original charge of Sunvis 916 in service indefinitely, effecting large savings in both oil and maintenance costs.

Sunvis 916 is a solvent-refined oil of the highest quality. It is fortified to resist the oxidation and sludging so detrimental to the efficient operation of hydraulic systems. Sunvis 900 Oils are *good for the life of your machines.* For your copy of the illustrated booklet "Sunvis 900 Oils", write Department AM-4.

SUN OIL COMPANY • *Philadelphia 3, Pa.*
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SUN PETROLEUM PRODUCTS
"JOB PROVED" IN EVERY INDUSTRY

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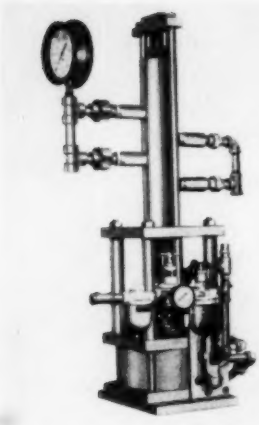


Hydro-Pneumatic Pump Provides Pressures to 20,000 psi

This pump is self-contained, uses normal plant air as the power medium, and provides pressures up to 20,000 psi at small volume. Design improvements make it more compact and lighter in weight.

Its use is in testing tubing, valves, and pressure vessels, in the operation of small molding presses, and in other services requiring high pressure at small volume.

The Aldrich Pump Co., Allentown, Pa.

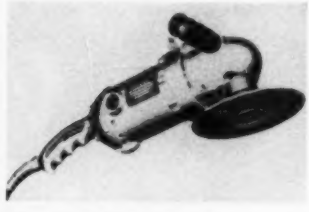
Diamond in Wheel Dresser Indexes Through 7 Stations

By a method of rotating the diamond through a sequence of seven stations, the Index-A-Point is claimed to lengthen the life-span of the diamond more than 1/3; reduce diamond setting to as little as 1/10, and improve finishes.

The tool is designed to give a wide range of approach angles to the grinding wheel and for this reason the diamond is offset in relation to the centerline of the shank. Whatever the angle of approach of the tool post or dressing fixture, the tool can be applied so that its head is in either a vertical or horizontal position.

A horizontal position is advised, however, because: (1) The diamond is then on the centerline of the abrasive wheel. (2) The matrix surrounding the diamond is clear of the grinding wheel and can not be gouged. (3) The device which locks the nib following indexing is more readily accessible.

Anton Smit & Co., 333 W. 52nd St., New York, N. Y.



Holt Portable Tool Is Jack of Five Jobs

Sanding any metal or wood surface; grinding the rough edges on welds, studs, bolts, or sharpening blades (with saucer or cup grinding wheels); wire brushing with a cup attachment; and planing and beveling are the five most important uses for this portable tool.

Known as the Spinner, it can be used with 7- or 9-in. Flexholt reinforced sanding disk pads. The side handle is detachable for right- or left-hand use. No-load speed is 4200 rpm. It comes with a 7-ft cable and plug, sanding-disk wrench, and ring for suspension.

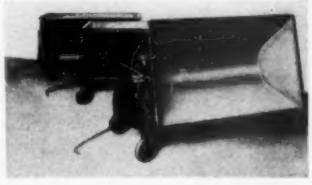
Holt Mfg. Co., 651 20th St., Oakland 12, Calif.

High-Bay Industrial Lamps Don't Collect Dirt

Because almost no dirt collects on the bottom of the bulb, the only place where light is emitted, these lamps are said to be especially useful in shops where dirt collection would cause severe reductions in light levels. For the same reason, they are advantageous in high-bay areas where maintenance costs increase.

Produced in both 500- and 750-watt sizes, the lamps employ a bulb design, the R-52, having a special contour to distribute the light downward, and a cutoff to give brightness down to 35° below the horizontal. The lamps measure 6½ in. across the face, and 11¾ in. in length. Downward candlepower, within an 80° cone, averages 4000 for the 500-watt lamp and 6000 for the 750-watt size. Price—$4 for the 500-watt size and $4.25 for the 750-watt.

General Electric, Nela Park, Cleveland 12, Ohio

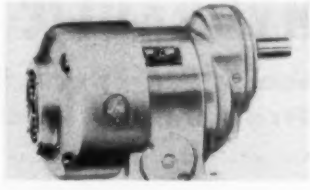


Shop Trucks Have Side Dump

Shop trucks to be used for any dry material, whether waste, parts, or other bulk material. They can be drawn by hand or power vehicle, singly or in trains.

The side dump eliminates shoveling when disposing of machine chips and scrap. The counterbalanced hod is made of sheet metal, welded at the joints. Frame is of structural steel and wheels can be of iron or rubber. Capacity is 1 cubic yd.

Klaas Machine & Mfg. Co., 4322 E. 49th St., Cleveland 25, Ohio

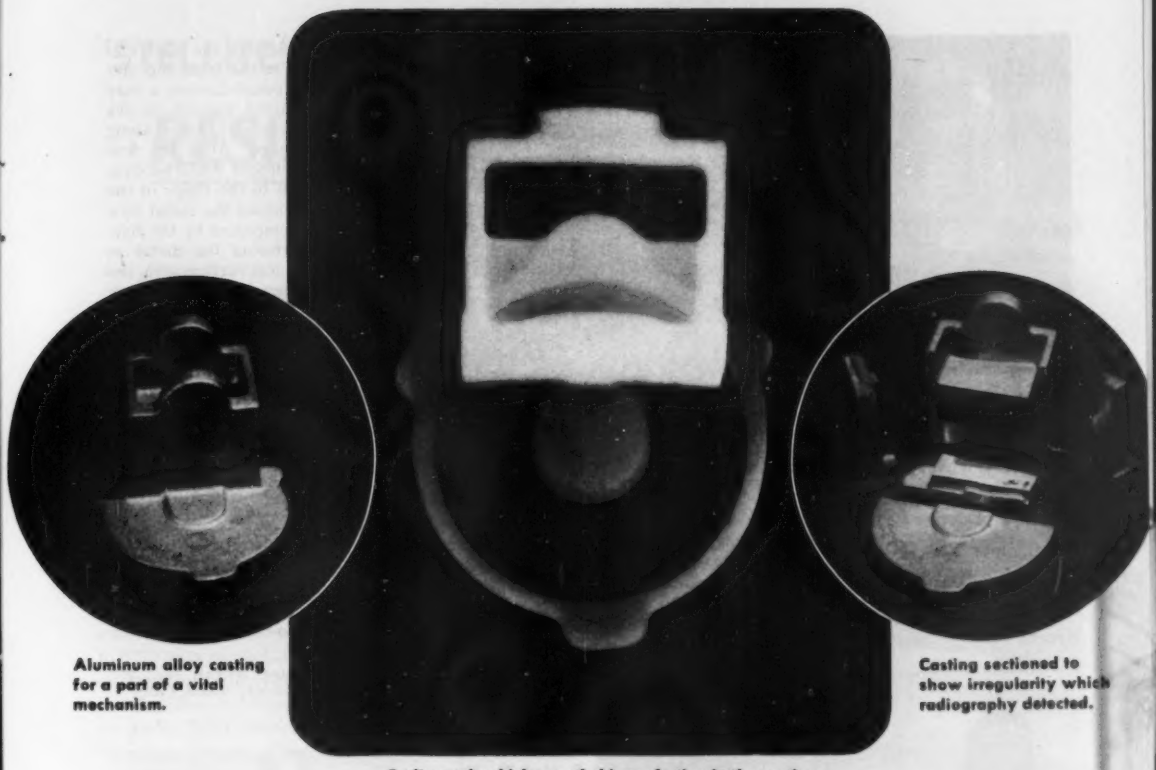


Sterling Geared Motor For Use in Injurious Atmospheres

Single-reduction geared motors have closed construction for atmospheres containing non-explosive dusts, vapors, and injurious foreign materials. An external fan forces blasts of air over the streamlined case.

Output—shaft ratings are the six AGMA speeds from 780 to 280 rpm. Known as the FWFA, the motor has labyrinth seals, lubricated-for-life ball bearings and a patented herringbone rotor. It can be mounted in any position without modification.

Sterling Electric Motors, Inc., Los Angeles, Calif.



Aluminum alloy casting for a part of a vital mechanism.

Radiograph which revealed imperfection in the casting.

Casting sectioned to show irregularity which radiography detected.

Radiography helps prevent delays in production

ALONG with scores of other castings, this one becomes part of an intricate mechanism. Extremely high quality is a must. Machining is long, complicated, and precise. Should the casting be imperfect, not only the piece and the machining time are lost—the flow of finished parts is disrupted and a whole assembly line delayed.

This is why it pays the foundry well to check the casting radiographically. It is the one way any foundry can be certain it releases only sound castings. And, equally important, it is a way that not only detects irregularities but, at the same time, indicates ways to revise gating, venting, pouring temperature, and other variables which influence consistently good work.

Ask your X-ray dealer to explain the many ways radiography can increase your yield and cut your costs.

EASTMAN KODAK COMPANY
X-ray Division • Rochester 4, N. Y.

Radiography...

another function of Photography

Kodak
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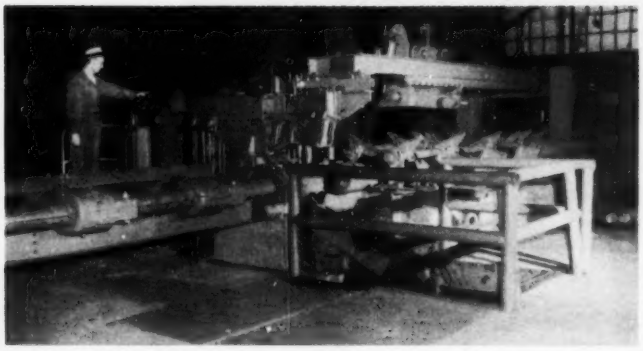


Linde Bar-Cutting Machine Speeds Pipe Manufacture

Oxy-acetylene cutoff machine for bar stock performs complete cutting cycle and retraction of head from work automatically. Roll tables and clamps were installed by mill and are not part of the machine.

Bars are placed by crane on a slanted table to the operators right. They pass from the table to the rolls which feed them under the bar cutter. The railed opening in the front of the photo is a chute down which slag and short lengths can be dumped into the bucket set into the floor.

The Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

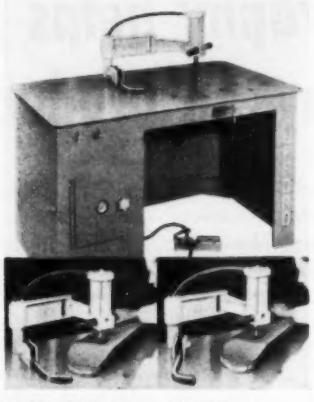
Airco Motorized Torch Holder Positions by Remote Control

The remote controlled raising and lowering of cutting torches mounted on oxyacetylene cutting machines is accomplished by this holder. Designed for attaching on the 3-in.-square torch bar of an Airco Oxygraph or Travograph, it allows the torch to move through 5 in.

The operator can, through a switch box mounted on the bar, actuate the four torches individually or simultaneously. Another control box is added for each additional 4 torches employed.

The holder can be put in four positions—vertical, 90° left or right and parallel to the longitudinal axis of the torch bar, and with an adaptor, 90° forward.

Air Reduction, 60 E. 42nd St., New York 17, N. Y.



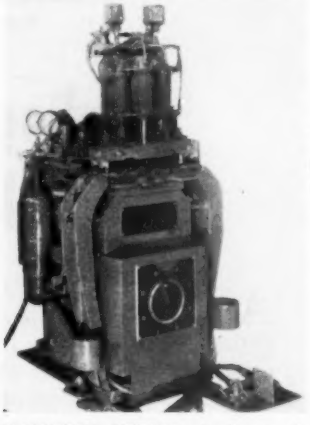
Hufford Finishing Machine Removes Wrinkles with Slapper

The shrink-finishing machine illustrated removes wrinkles from parts formed on rubber-pad presses. The defects usually occur when an edge is turned and the part placed in compression.

A pedal releases air to a pneumatic clamp which secures the part and its form block to the table top. By depressing the pedal further, a lead slapper is actuated parallel to the table, striking a series of blows along the wrinkled edge. After the first few blows, the slapper conforms over its entire length to the shape of the work. By restricting the metal flow to the area encompassed by the slapper and compressing the metal so that it occupies less surface area, the wrinkles disappear. The form block and workpiece are rotated to cover the entire perimeter. Frequency of the blow can be altered.

The work and form block are next taken to a Hufford planishing machine which consists of an air-driven hammer mounted on a smooth table top. The hammer is activated by pressure of the work against the head. A series of short hammer blows eliminates any minor defects remaining from the previous operation. To finish work of different heights, the planishing assembly is equipped with two elevating screws. A removable workhead is employed so that the shape can be chosen to suit the job.

Hufford Machine Works, Inc., 207 N. Broadway, Redondo Beach, Calif.

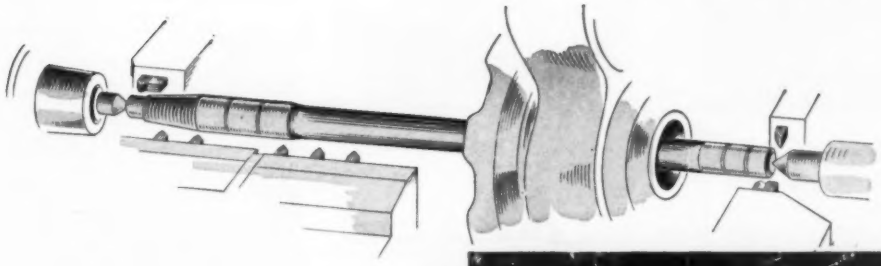


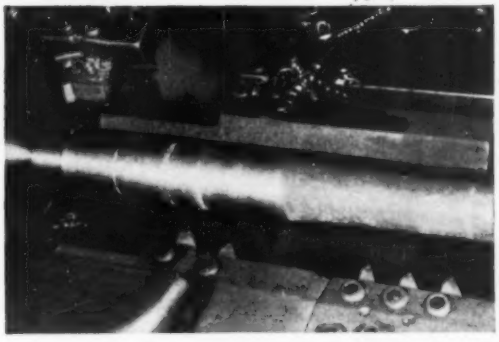
FLASH-BUTT WELDER simultaneously joins both ends of a tubular chair rung to the tubular legs of metal chairs. Two vertical pneumatic clamps are used for holding the rung in the lower dies. Flashing and upsetting are automatically accomplished by an air-cylinder actuating gear-and-rack mechanism interconnecting the right and left platens. Known as the BMFU-75, the machine is rated at 75 KVA for 220 or 440 volts, single-phase, 60-cycle power supply.—*Sciaky Bros., Inc., 4915 W. 67th St., Chicago 38, Ill.*

"STELLITE" ALLOY TOOLS

RESIST CHIPPING and WEAR

on this production job





Tool setup for machining rear axle shafts. The HAYNES STELLITE *98M2 tools used in this lathe turn out 200 pieces per grind.*

Machining 200 pieces per grind—when the part is made of an alloy steel with a Brinell hardness of 300 to 325—calls for tools that are unusually tough as well as extremely abrasion-resistant. The tools have to resist spalling and chipping because they are subjected to shock. They have to have exceptional abrasion-resistance because of the hardness of the part being machined.

The part—a rear axle shaft—is long and has a relatively small diameter. The pressure of the tools on its surface during the machining operation causes it to vibrate. It is this vibration that chips and breaks brittle tools. The shaft is machined in a multiple tool setup where the failure of even one tool, either by chipping or from excessive wear, causes a shutdown.

Toughness and abrasion resistance are a big order for any tool—yet the HAYNES STELLITE 98M2 tools being used on this job are meeting all the mass-production requirements of a modern automotive machine shop. These tools take heavy cuts at high speeds and turn out more pieces per grind; they can be used for both rough and finish machining operations. Write to the office nearest you, or to our general sales office in Kokomo, Indiana, for more information and price lists.

Part	Axle Shaft (300 Brinell Steel)
Pieces Per Grind	200
Speed	300 rev. per min.
Feed	.016 in. per rev.
Depth of Cut	½ in. to ⅛ in.
Tools	HAYNES STELLITE 98M2 (½ in. sq. x 4 in.)

HAYNES
TRADE-MARK
Alloys

Haynes Stellite Company
A Division of
Union Carbide and Carbon Corporation
UCC
General Offices and Works, Kokomo, Indiana
Sales Offices
Chicago — Cleveland — Detroit — Houston
Los Angeles — New York — San Francisco — Tulsa

"Haynes," "Haynes Stellite," and "Stellite" are trade-marks of Union Carbide and Carbon Corporation.

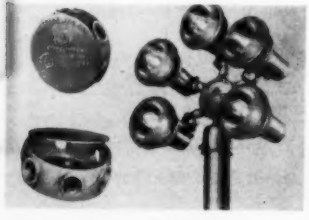
Simonds Footswitch Treadle Has Non-Skid Rubber Tread

The treadle on these footswitches is said to require little pressure, with the angle arranged to prevent fatigue. The formed-steel casing has a black crackle finish.

The model T-51-S Treadlite, which may be wired normally open or normally closed as preferred, is a single-pole, double-throw, momentary-contact switch rated for 5 amp at 110 or 250 volts. Price is $2.95 without cord.

The model T-52-S is identical in appearance and size, but provides 2 switching operations activated by one treadle. A partial stroke operates one, a full stroke, the other. Both of the switches are single-pole, double-throw. Rated at 5 amp at 110 or 250 v, the unit is priced at $4.20 without cord.

Simonds Machine Co., Inc., Southbridge, Mass.



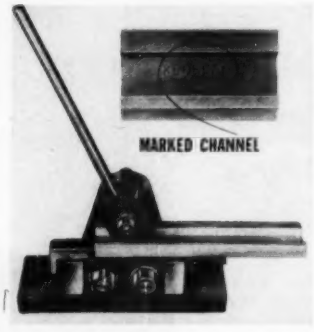
Stone Outdoor Floodlights Conserve Critical Aluminum

Weatherproof cluster lights are for outdoor protective lighting, factory yards, boundary fences, etc.

The unit is made of tough aluminum alloys that are die cast under high pressure to provide good strength with less aluminum by weight than conventional wiring troughs. A removable cast-aluminum cover plate sealed with a heavy cork gasket provides quick access to inside wiring.

Each box has six holes tapped ½-in. IPS to take from one to five standard lampholders for the 150-, 200-, and 300-watt reflector bulbs. Accessories available include slip fitters for pipe mounting and brackets for wall mounting.

Stone Mfg. Co., Elizabeth 4, N. J.

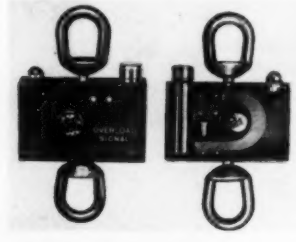


Cunningham Marking Machine For Aluminum Channel

The CM-50 machine will mark a channel section by a movement of the handle from left to right. A deep, clear-cut mark without distortion is said to be produced. A spring returns the mandrel to position for the next marking. The roll die can be made with lettering engraved on the solid roll.

The base or mandrel section is machined to suit individual channel shapes. Mounted on needle bearings, it is made of solid steel.

M. E. Cunningham Co., 95 E. Carson St., Pittsburgh 19, Pa.

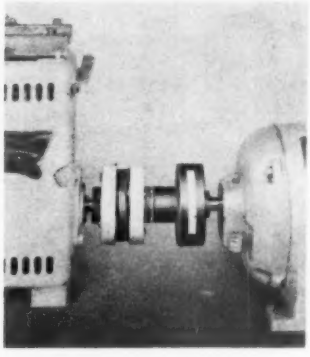


Overload Warning Signal For Hoists and Cranes

Automatic overload signal is for those installations where it is not desirable to cut into the hoist motor circuit. It consists of a U-shaped pressure bar to which is mounted a sensitive micro-switch. Setting is made for any point between 500 and 10,000 lb by means of the load setting screw. Should this load be exceeded, the red warning lamp lights up, and a shrill warning signal is emitted by the klaxon.

Power supply is furnished by two ordinary flashlight cells. The eyebolts are prevented from turning by a locking arrangement.

W. C. Dillon Co., Inc., 1421 S. Circle Ave., Forrest Park, Ill.



Mercury Clutch Coupling For Electric Motors up to 15 hp

The Series E clutch coupling is designed for installation on the shafts of integral-hp electric motors with ratings up to 15 hp. The unit, used in conjunction with a flexible coupling, provides a satisfactory connection between the motor and driven shafts without the necessity of maintaining exact alignment.

Automatic Steel Products Inc., Canton 6, Ohio

Solenoid Shut-Off Valve Made Corrosion Resistant

The LDS-2-750 two-way capacity valve features positive seal, ports in line, and only one moving part. It owes its corrosion resistance to a cast naval-bronze construction. Valve design permits mounting in any position without harm to the valve or solenoid. Inspection and servicing after original installation can be made without disturbing the piping.

The valve can be used for the control of such fluids as oil, water, or air. Pressures range from 0 to 225 psi, and it operates on either ac or dc. It can be furnished in standard sizes of ¼ through 2 in.

Airmatic Valves, Inc., 1643 E. 40th St., Cleveland, Ohio

If you are concerned with the design or manufacture of products—military or civilian—which call for the use of metal components, you should be receiving The Alloy Pot. For 18 years this publication has had a single purpose—to point the way to increased productivity through the well-planned use of zinc die castings in product design.

As The Alloy Pot begins its 19th year, industry faces a challenge quite different from the one faced in the early 1940's. Now you are asked to build the tools of war and still maintain adequate civilian production in the face of a drain on manpower by the Armed Forces. Since zinc die castings represent the shortest distance between raw material and finished part they undoubtedly will provide the answers to many of the production problems of 1951.

The Alloy Pot will give you *specific examples* of increased productivity and lower costs through the use of zinc die castings.

Write to
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THE NEW JERSEY ZINC COMPANY
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Dept. A.M.
to receive
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The New Jersey Zinc Company • 160 Front Street, New York 38, N. Y.

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Division of Simonds Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N. Y., Simonds Canada Saw Co., Ltd., Montreal, Que. and Simonds Canada Abrasive Co., Ltd., Arvida, Que.

ROUND TABLE Discussion

WHAT'S NEWS?

COMPANY publications should be bright and informative—always. A few harmless digs at the higher-ups and the lower-downs, judicially mixed, stimulate interest and contribute generally to increased circulation. Most people in industry have a sense of humor and a few harmless quips at their expense have a tendency ot whet their appetite in anticipation of the next issue. This creates interest and when interest is thoroughly aroused circulation improves

A bright, well-balanced publication will not fail to quicken the interest of even the dull ones and if the undertone is so designed the interests of the company will be indirectly served. Pictures should predominate. Pages of solid, unrelieved reading matter are unlikely to attract new readers as they are likely to try existing subscribers.

In all cases a nominal charge should be made for the magazine; that which is got for nothing is usually regarded as commonplace and in too many instances is not appreciated. The interests of the company should be quietly but firmly featured throughout the pages, in the spirit that the vital interests of the employees are bound up in the fortunes of the firm.

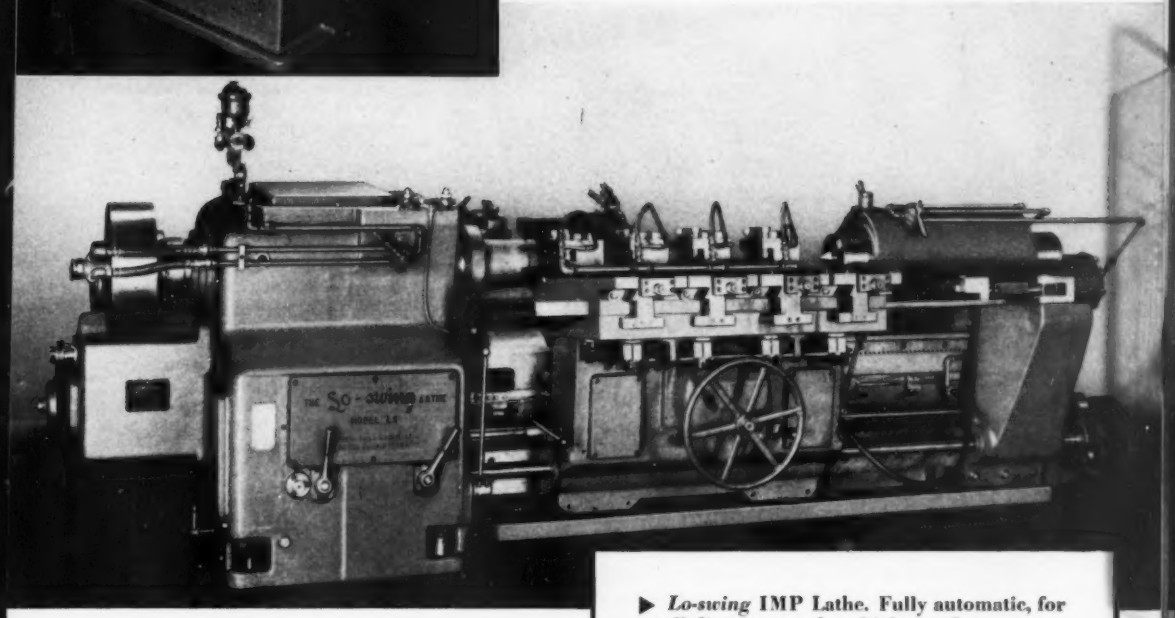
There are, of course, many ways of keeping the interests of the company before the readers, the line decided on calls for a light touch, and wherever possible, pictorially. In this connection, plain statements of fact with uncompromising figures and deductions can be very indigestible and are unlikely to stimulate interest or enthusiasm in the vast majority of men and women although, here and there, in every plant, there are to be found the exceptions. In order that *they* may not feel overlooked, judicious amplification of casual statements can be conveyed through the medium of a "you asked for it" feature. Lightly treated, explanatory replies to requests for more dope on dry matter can be highly amusing and informative.

The house magazine of a large steel firm in Scotland ran, in serial form, a feature calculated to stimulate interest in the affairs of the company with the object of impressing on the minds of the employees the widespread ramifications of the

PROVED ON ORDNANCE WORK

Lo-swing IMP, proved on 40 mm shells and small Ordnance Parts.

Model LS Lo-swing proved on 105 mm Gun Barrels, and 220 and 240 mm Shells.

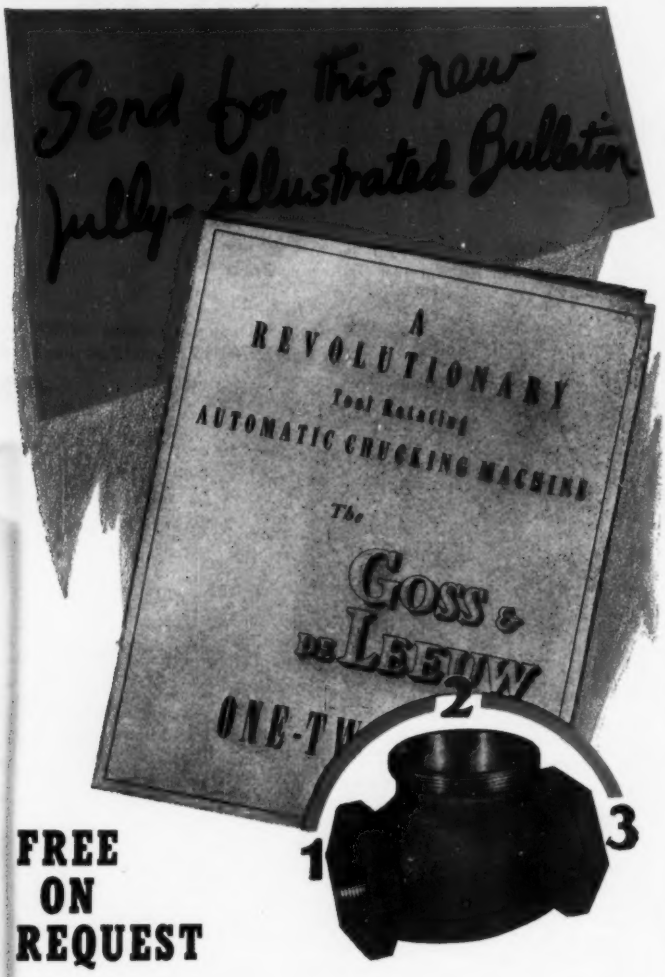


DURING WORLD WAR II, *Lo-swing* Lathes demonstrated their productiveness and stamina on a wide range of Ordnance Work...40, 75, 90, 105, 155, 220 and 240 mm Shells—50 and 81 mm Trench Bombs—20, 40 and 105 mm Gun Barrels — camshafts, cylinder sleeves, radial aircraft cylinders, landing struts, large diesel engine cylinders, etc. The Model CS Centering Machine was used extensively on 75, 90 and 105 mm Shells.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

- ▶ ***Lo-swing*** **IMP Lathe. Fully automatic, for small diameter work at high speeds.**
- ▶ **Model LR *Lo-swing* Lathe. Fully automatic, for medium sized work.**
- ▶ **Model AR *Lo-swing* Lathe. Fully automatic, for medium and large size work.**
- ▶ **Model R-14 *Lo-swing* Lathe. Fully automatic, for large size work.**
- ▶ **Model AP *Lo-swing* Lathe. Semi-automatic, for work requiring long carriage travel.**
- ▶ **Model LS *Lo-swing* Lathe. Semi-automatic for turning long gun barrels and heavy shells up to 13" in diameter.**
- ▶ **Model CS Drilling and Centering Machine. Fully automatic for all centering operations.**

Lo-swing AUTOMATIC LATHES



FREE ON REQUEST

Here are the answers to most of your questions as to what "ONE-TWO-THREE" means in describing this outstanding development of Automatic Chucking Machines by Goss and De Leeuw. You'll be interested not only in the revolutionary design of the machine itself, but also in its extraordinary performance—and how it is possible to handle from one to three operations—in sequence or simultaneously without changing set up.

Get this interesting, informative Bulletin NOW—by merely asking for it.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

concern with which they worked and the international importance of the work of their hands. It was well illustrated and depicted the complete cycle of operations from mining the iron ore to the leading of the finished article on rail trucks. In the case of home orders the "follow up" consisted of pictures with captions, showing the plant being installed in the customer's works and later, in operation on the customer's product, a short description of which was also given. Foreign orders were shown at the docks being loaded onto ships and being unloaded at their destination. Many interesting pictures and some equally interesting printed matter described the difficulties of transport and installation in foreign lands still in the early stages of industrial development. Such was the popularity of this feature that it was screened and lectured on at the unanimous request of the works personnel.

A works magazine can be a vital factor in the success of a suggestions scheme by providing a laudatory write up of all suggestions accepted and paid for. Whenever possible this should take the form of an illustrated article showing the previous method or tool employed, alongside the new method accepted. The name of the man responsible for the successful suggestion, along with that of the section, should be given prominence, with a short resume of previous successful submissions, if any, by the same man. Unsuccessful tries can be briefly touched on with a word of encouragement on better luck next time lines. The names of the unsuccessful need not be disclosed unless special circumstances dictate otherwise. It would be a mistake to publish only light social and personal matter in a plant magazine. If it is to play its full part in the organization it must also deal with the more serious side of the business.

C. D. Mackinnon
Airdrie, Scotland

•

"TALENT alone cannot make a writer. There must be a man behind the book." This quotation by Emerson can also be applied to the setup of the plant magazine. Interesting news items about plant personalities alone cannot make a good company publication. The company must be behind it to infuse life and usefulness into its columns; to tell the employees the important economic facts that affect their daily lives, their jobs, their industry. Management should use the plant magazine to help employees understand the way our

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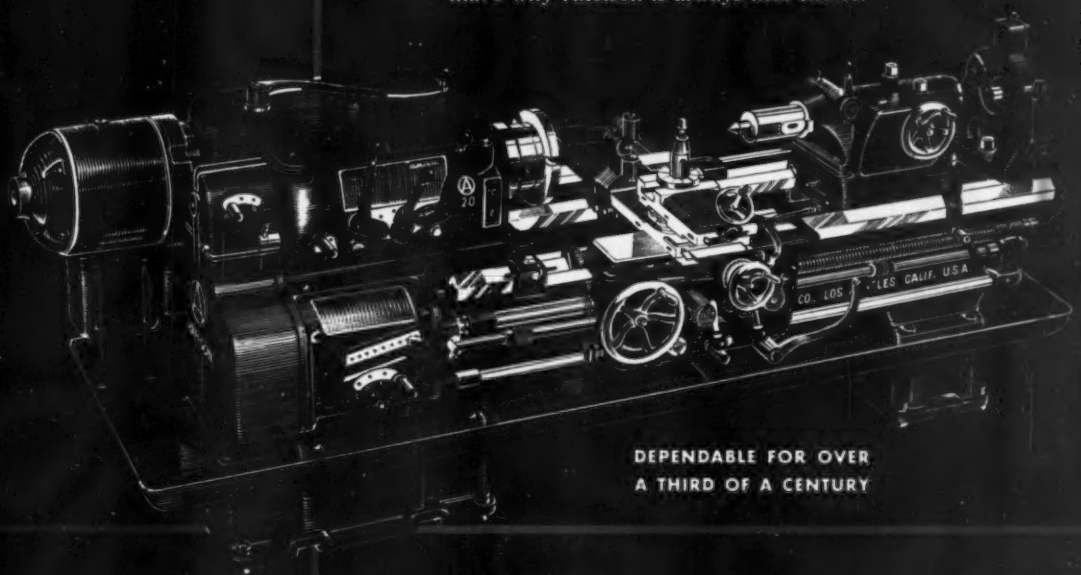
ENGINE LATHES

Axelson lathes produce more work of higher quality with fewer rejects at lower unit costs. Long experience of users proves it pays to choose Axelson – that's why Axelson is always first choice.



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2 MODELS:
Standard and
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Designed to give guaranteed accuracy on high speed and tungsten carbide work—the OLIVER ACE grinds difficult cutters easily. Simple to set up, easy to operate, faster on most grinding operations, the ACE requires no computation—has direct reading for clearance. Its uses are almost unlimited. It excels for grinding face mills up to 15" • slab mills • end mills • slitting saws • dovetail cutters • angular cutters • double angle cutters • gear cutters • Fellows helical cutters • reamers • taper reamers • production gashing. AND the OLIVER ACE is priced to meet your budget.

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AUTOMATIC DRILL GRINDERS · TOOL & CUTTER GRINDERS—DRILL POINT THINNERS—TEMPLATE TOOL GRINDERS—FACE MILL GRINDERS—DIEMAKING MACHINES

economic system functions, to point out the relationship between profits and employee welfare, stressing the need for profits to build and attract capital. There should be shown the relationship between capital and costs, efficiency, product development, prices and competitive position; hence to job security, living standards, opportunity and working conditions.

In its articles, the company publication should be used to promote the company but it should be done in such manner that it is to the advantage of employee and employer alike. Employees should be urged to build quality, prevent waste, and help keep down costs. The beneficial effects of such effort on company and worker welfare should be stressed. In line with this, one plant publication published tables which were used to show monthly scrap losses, in quantity and dollars, which could be reduced at substantial benefit to both employer and employee. Another plant publication pictured its common tools alongside their cost for the year. A pictorial reminder of the cost of lost or damaged tools was worth a dozen printed essays or verbal admonitions.

Articles have been used emphasizing some aspects of direct application to labor, such as cooperation, opportunity, job security, productivity, wages, standard of living, legislation, and labor relations. Interesting articles in some plant magazines have also compared the problems of the manager with those of the employee. In one plant magazine the theme of opportunity was tied in with the company's employee training program.

However, many management people have a conscious policy against using house magazines for company promotion. They want to keep big

"All I know is that the boss puts it out there every pay day."

POP'S school of Filing

POP'S GIVIN' PINHEAD HIS FIRST LATHE FILIN' JOB
YEH, AN' PINHEAD'S ABOUT AS MIXED UP AS A BATCH O' CONCRETE
HE CAN'T FIGGER OUT HOW TO MAKE THE LATHE WORK THE FILE TO FILE THE WORK
THE KID MUSTA BEEN BORN TWISTED-AN' WITH NO BRAINS WOT-SO-EVER

THE lathe rotates the work and not the file, of course—as anybody but Pinhead would know. But not every lathe mechanic knows of the existence of a special Nicholson file that works very fast and does a beautiful job of smooth-finishing on spindles, shafts, dowel pins, hubs, gears, rolls—anything, in fact, that can be set up and spun in a lathe.

It's the Nicholson Long Angle Lathe File (also made in Black Diamond brand). Though a regular Mill Bastard will do a good job and is a bit easier to use, this special file, with teeth angle increased from 25° to 45°, has less tendency to fill up. The chips slide down the longer angle and are forced out at the edge by the "forward" motion of both the file and the work. Consequently, there is less chance of chip-scratches on the surface being smoothed. (A stroking action, under light pressure, should be used to distribute the cutting throughout the file.)

Made in Flat type with "Long Angle" stamped on tang; and sold through industrial supply houses. Unsurpassed Nicholson quality, of course.

FREE TECHNICAL BOOKLET, "*10 Special File Types.*" Also, "*File Filosophy,*" Nicholson's famous 48-page illustrated book on kinds, use and care of files. *Free*—as many copies as you need for purchasing and production heads and key mechanics.

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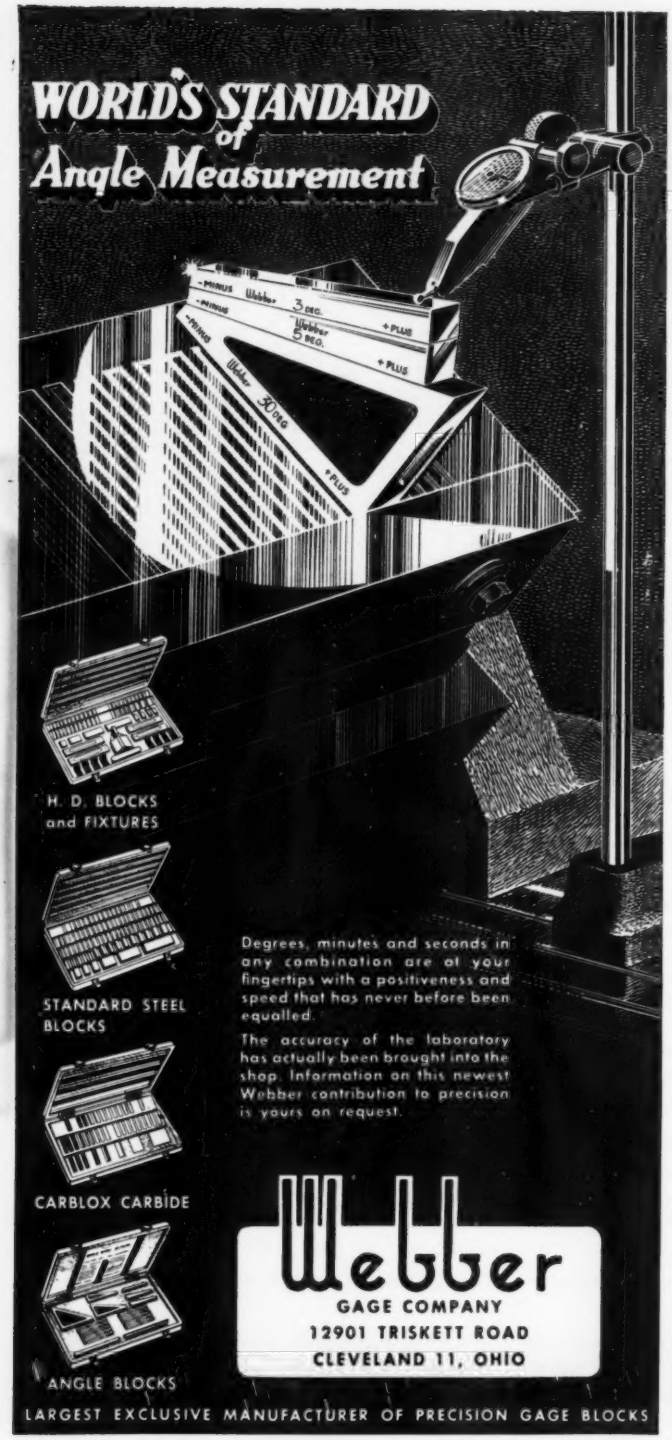
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Degrees, minutes and seconds in any combination are at your fingertips with a positiveness and speed that has never before been equalled.
The accuracy of the laboratory has actually been brought into the shop. Information on this newest Webber contribution to precision is yours on request.
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ideas out. They believe house magazines should be confined to material "of interest," or "for the enjoyment" or "for the satisfaction" of their employees. One cannot help but wonder what would be of greater interest to employees than an understanding of the problems of management and how they are being solved; what would be more enjoyable and satisfactory to the employees than learning what the company is doing to make their jobs better and more secure.

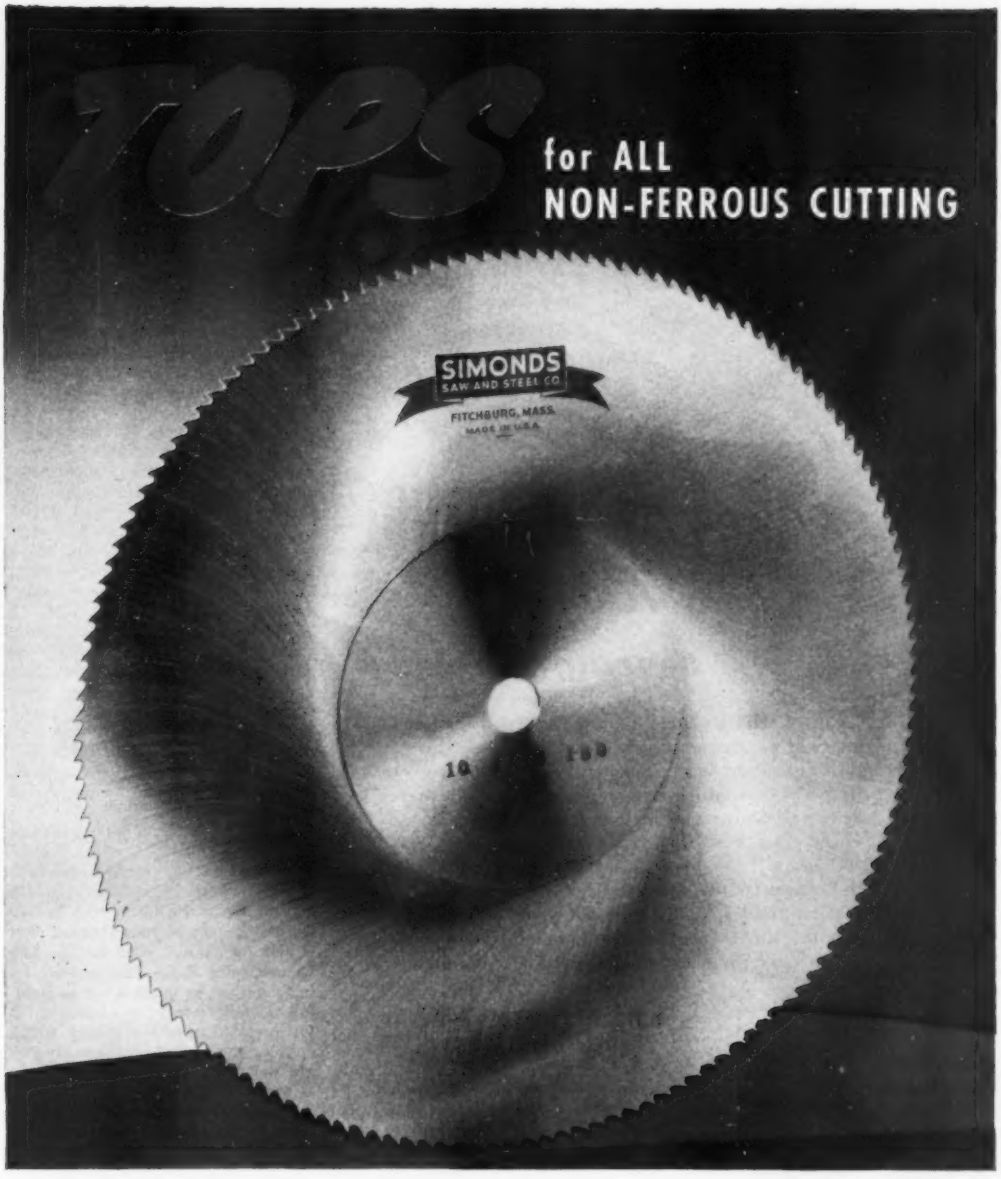
Plant news and personal items are an important element in the makeup of the magazine. Another important element in the context of the plant publication by which the company and its products may be promoted is what might be described as "product news." In it, the employee is familiarized with the variety of products, the new developments in them, and information as to their special virtues and evidences of public acceptance. It appears that employees are always interested in the ultimate results of their work, for their product information is close to personal news in its appeal. This publicity benefits both company and employees by promoting cooperation and mutual interest in making a better product.

Just as customers are reminded of the value of the products they buy, employees may be reminded of the benefits of their jobs—of those "plus" values that make the company a good place in which to work. The plant magazine is the ideal place to publicize such "plus" values. And one of those "plus" values that makes the company a good place in which to work is the plant magazine.

However, in any type of plant magazine, when it comes to the question of having foremen contribute articles dealing with interesting aspects and problems of their work, I believe it is a good policy to have correspondents among the employees, especially the foreman. It is

"Arrowheads will suffice, Higgins. You can dispense with the feathers."

TOPS for ALL NON-FERROUS CUTTING



On all non-ferrous metals, here's the toughest, most "stand-up-and-take-it" saw made . . . with a proven production record on everything from light-wall sections to solids.

SIMONDS heat-treats these saws for individual applications, according to speed, type of material, and machine. And SIMONDS design assures top cutting efficiency . . . with correct tooth-shape that eliminates clogging of gullets . . . with high, smooth finish that resists adherence of chips to plate . . . and with proper clearance for freer, cooler, straighter cutting.

Standard sizes are immediately available from stock . . . so see your Simonds Distributor *today*.

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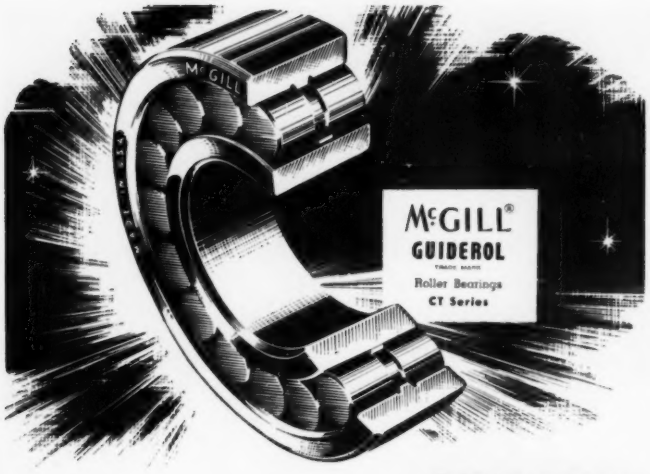
Branch Offices in Boston, Chicago, San Francisco and Portland, Ore. Canadian Factory in Montreal, Que.



NEW PRINCIPLE of GUIDEROL

...solves your TOUGHER bearing problems

The McGill GUIDEROL Roller Bearing is especially designed to take advantage of the greater capacity of cageless roller bearings — without the danger of roller skewing. This new principle of construction features guided rollers that overcome skewing tendencies and eliminate the need for space wasting cages and excess internal looseness. Load capacity in cylindrical roller bearings is not only increased with Guiderol Bearings but this advantage is effectively applied to faster and more precision applications—not before possible with full type cylindrical roller bearings. You will profit by investigating these and many other advantages of Guiderol Roller Bearings.

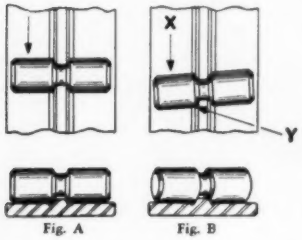


Fig. A Fig. B

GUIDED ROLLERS PREVENT SKEWING—BINDING

A guide rail on the inside diameter of the outer race maintains roller alignment. Normally no correction is required. Should misalignment cause tendency to skew, the guide rail touches grooved rollers back into position by momentary contact at Y. X indicates direction of roller rotation.

Bulletin GR-50 lists proposed standard sizes in CT Series (interchangeable with cylindrical type dimensions) and FT Series (interchangeable with ordinary needle type dimensions). Write McGill Manufacturing Co., Inc., 111 N. Lafayette St., Valparaiso, Indiana for your copy.

McGILL® precision bearings

believed that a friendly and interested working force can be achieved to some extent by having numerous correspondents among the employees, particularly the foremen. Their literary style and vocabulary limitations should give the magazine a distinctive color and flavor.

Harry Kaufman
Philadelphia

•

HEAD BEATS HANDS

THERE ARE lots of speed demons in machine shops and they shine mostly on work that don't require the use of brains. Most of them are found wanting when a difficult piece of work comes along, that requires both hands and brains.

If I had been in Madison's position, after finding out that Laziazell had changed the method making the work much easier and the production much greater, and seeing that Laziazell don't like to work hard, I would bring back Butter the Speed King who, by using the methods Laziazell introduced, will produce far more work than Laziazell.

Now it might pay Madison to look around his department, where he will no doubt find other work that has been going on for some time, using methods that can be vastly improved, which he has failed to observe due to lack of ability and initiative. Here he could use Laziazell practically continuously as a trouble shooter.

It's always a sin if on account of it someone else has to work harder to make up for someone's laziness. If you are unemployed through lack of a liking to work and your family suffers because of your laziness, that is sinning against your family, like Laziazell did. If you just loaf on the job it is just as much a sin as stealing money from your employer. If fortunate to have the money which enables you to loaf continuously you are definitely sinning against yourself.

I think that before anything can be done to transform a lazy man into an industrious person, I would find out just what kind of work the chap prefers to do, if any. Second, find out if he has any aptitude or ability along the lines he prefers. Assuming that he prefers a machinist job, he should be given the opportunity of making good in that line.

I believe that in lots of instances, where a boy develops into a lazy man, it is due to being put into a line of work he has no liking for, or aptitude for it. He just hates his job, it embitters him and if circum-

CONTROL in the manufacture of gears is, we think, a matter of complete control . . . control of every operation.

• At BRAD FOOTE we have complete control of each step from the inception of the original design to the delivery of the finished gears you use. For here . . . in our own plant . . . we design, engineer, machine, heat-treat, test, inspect, clean, and finish every gear. No one shares our responsibility.

• Our control guarantees the quality of BRAD FOOTE gears . . . gives you assurance that the gears you buy will perform satisfactorily when used in your shop . . . or on the equipment you sell to others.

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IN FITTING PARTS FOR ASSEMBLY
WHICH ARE YOU USING?

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Yet a penknife—and a LAMINUM shim—make spacings in thousandths a routine matter!

It's because these *adjustable* shims are fabricated from stock containing from 3 to 63 layers of .002" or .003" brass or steel, solidly bonded together. The laminations peel easily with a penknife.

Interesting?—SEND TODAY for our free engineering data file and sample of LAMINUM.

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THE SOLID SHIM
THAT PEELS FOR ADJUSTMENT

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stances are so that he finds he cannot change he loses any interest he might have had and develops often into a bum. There are lots of instances where a young man has lost quite a few jobs because of inefficiency and lack of initiative and apparently no interest on the job, and got the name of being a lazybones and then he has had the luck to strike a line of work that he really wanted to do and has made good in a big way.

It is instances like that that would make me hesitate to say that effective handling or the right type of work could not interest or possibly change the laziest young man into an industrious workman.

Arthur Silvester
Niantic, Conn.

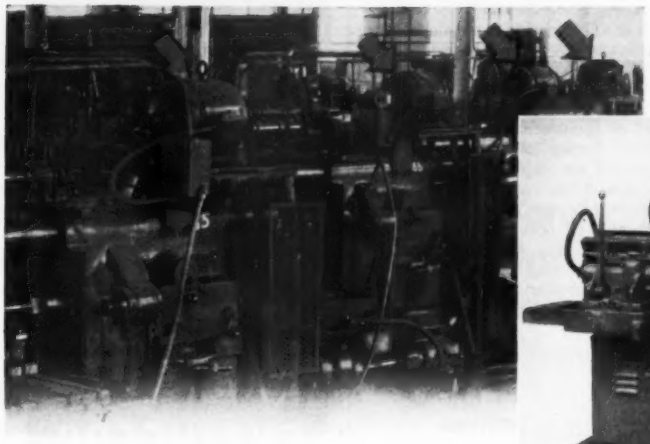
•

SKILL STEALER

THE QUESTION of enticement or, more openly, the stealing of skilled labor, is surely a moot point; the use of the term "stealing" might even be queried. The challenge might be made that he who is without fault in this respect should cast the first stone. Would there be a run on stones and would any one place be dangerous? One might wonder if Al himself would feel he was justified in having a shot. This however would be to treat the matter superficially, but it is one of some depth.

In arriving at a decision, it would be well to consider the opposite course; let each official look around his own shop and note how many of the men were home trained and of these who were the better, the more versatile; those who had stayed at home or those who had sought pastures new, who might have come even from the Gibbons Manufacturing Company. If many strangers were found, what would have been the position if all had stayed at home.

It would seem that the position must always be one of give and take, each firm training its own share. Some still will stay at home but the more adventurous will want to stretch their wings and see how this and that firm do their work; absorb or reject their methods and, it may be, if the conditions at the old firm were good, seek to return some day and settle down. Such men, because of their more general experience, could become valuable members of the firm's more permanent staff. The Als must be willing to take the rough with the smooth in the working out of events and, if it is more rough than smooth, they might take



Four Century 5 horsepower squirrel cage motors operate milling machines

Century 5 horsepower motor driving a grinder

Century

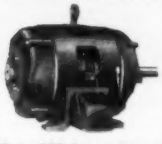
TYPE SC-
SQUIRREL CAGE MOTORS

⅛ to ¾ horsepower

1 to 1½ horsepower

2 to 15 horsepower

20 to 125 horsepower



150 to 400 horsepower

Equipment Producers Select Century Motors

To Give You Long-Life Performance With Least Down-Time

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19651 JOHN R STREET
DETROIT 3, MICHIGAN

WRITE FOR CATALOG

stock of themselves and make sure they are not seeking to eat their cake and yet retain it; this just cannot be done.

At the same time there is a case and where few are innocent some kind of agreement is desirable. The writer knows one large district where all the employers within 12 to 15 miles radius agreed not to engage each other's men without their consent and to observe certain wage rates. This was successful in stopping the filching and otherwise of good workmen and in a general way, is believed to have worked satisfactorily.

P. E. James
Lindum, England

•

OUT TO PASTURE?

A MAN is just as old as he feels; a woman too, for that matter. Age is not now a true yardstick of usefulness; physical and mental ability are much more dependable in that connection. Due to a better standard of living over the years, better housing and sanitation, more sensible observance of commonsense health rules, better hygienic conditions in home and factory, men and women are living longer and more effectively. Today, the conception of 65 years as the age for retiring is all wrong and should be insisted on only if the 65s employed prevent the 16s from obtaining employment. So long as there is work for both in the factories, both should be employed. What the over-65s may have lost in speed is more than offset by dexterity and wisdom. This applies in the case of the average man and woman. If we ever reach the stage when the world's work can be overtaken without the help of the "old uns" they can then be released to occupy their remaining years in congenial and perhaps less extracting pursuits. A long experience of laying off the over-65s has taught me that the vast majority prefer to usefully occupy their time rather than to fritter it away in comparative idleness. A typical and authentic example: Old Tom and the boss had served their apprenticeship together. The boss had been ambitious and had prospered; Tom had been content to be a toolmaker. When they were both about 70, the boss told his manager to tell old Tom that he had served him well and truly and should not now need to toil. He had arranged for him a handsome retiring allowance to be paid from the following week. The following Monday morning, however, found old Tom at his bench as usual and when the manag-

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INQUIRIES PROMPTLY ANSWERED

er asked if he had not understood that he did not need to work, the old fellow replied "If Sir Arthur does not know when he has a good man I know when I've got a good job." He was allowed to carry on.

I quote from a recent article in *The Machinist* on "How Britain Trains Apprentices": At the present time Britain is facing an acute shortage of craftsmen because a whole generation of apprentices has been skipped by six years of all-out war." The same could be written of almost all industrial countries in the world and when one takes account of the number of qualified engineers who went down in the holocaust 1939-1945 and reviews the vast amount of reconstruction work the world over still to do, it is not difficult to see why highly skilled veterans are such an industrial gold mine today. In addition to their acquired skill and wide experience, their presence in the shops, while lessening the burden of responsible executives has a steadying effect on the more volatile younger fry. The quality of example is still potent in the shops. Few of the older men set a bad example. The steady demonstration of their acquired skill, cunningly applied, is still infectious and has its ardent youthful imitators in every factory, to the lasting benefit of the imitators, the industry and the world at large. I am not so sure that training apprentices is just the job for the over-65s. Probably younger men with good experience, whose own youth is less of a memory, would be quicker at appreciating the youngsters' point of view and gaining their confidence. But as things are today, I have no doubt about the wisdom of retaining the services of even the over-70s, provided they are reasonably fit, mentally and physically, and are employed on work which they have been accustomed to do.

C. D. Mackinnon
Airdine, Scotland

•

SAFETY LAST

IT APPEARS that Donaldson, a chap in Al's department, was using the grinding wheel without taking the precaution of wearing goggles. A chip from the wheel that broke off injured one of his eyes, making it necessary to go to the nurse for first aid.

I believe that this type of accident today should be punished. In my younger days it often happened and it was really difficult to prevent it. There were no goggles in engineering shops at that time, but also there were no emery wheels. The type of

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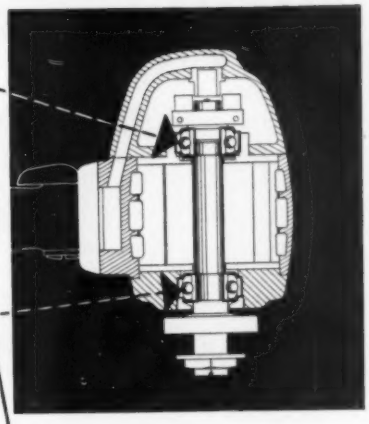

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grinding equipment was the old grindstone and hardly anyone ever had an eye injury.

The vast majority of equipment used in most any shop today is properly guarded at all danger points. If instructions are carefully carried out it is practically impossible to have an accident.

In my humble judgment, if every foreman was held responsible for his employees' working safely at all times it would cut down on the accident rate.

You can have a safety company bonus award, safety slogans planted all over the shop, cartoons showing where an accident has just occurred and the victim being carried away on a stretcher, but they are not nearly so efficient in prevention of accidents as is generally supposed.

Is there a quick and easy way? Apparently there isn't. We still have preventable accidents. I believe that the only way of keeping them to an absolute minimum is in constant never-ending education, talking and reminding and enforcing all safety rules and practices, and in my judgment the foreman is the key man in prevention of accidents.

If every foreman got tough and stayed that way every day, all day with regard to unsafe practices and carelessness and each man knew that, they would not think of going to a grinding wheel without using goggles or doing any job without using safety precautions.

Finally I believe that made union officials should also continually urge all members to preach and practice safety measures. It is just as much their interest and responsibilty as it is the employer's to provide all safety measures and to see that their members use them.

Arthur Silvester
Niantic, Conn.

•

FIRE OR FIZZLE?

A FAMOUS *American* philosopher named Lowell once said: "The foolish and dead alone never change their opinion."

A progressive foreman will certainly change his previous negative opinion of the value of the "evaluation interview," unless he is either foolish or dead, where experience has demonstrated the effectiveness of the interview as a means of salvaging the services of a worker through his transfer to another department, where he may be better fitted for the work.

The worker recommended for discharge by his present foreman may

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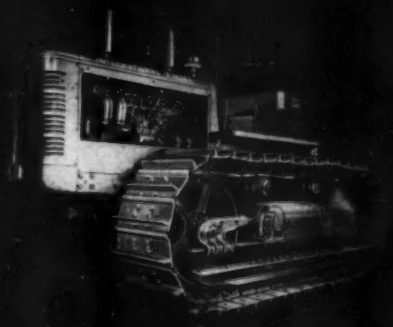

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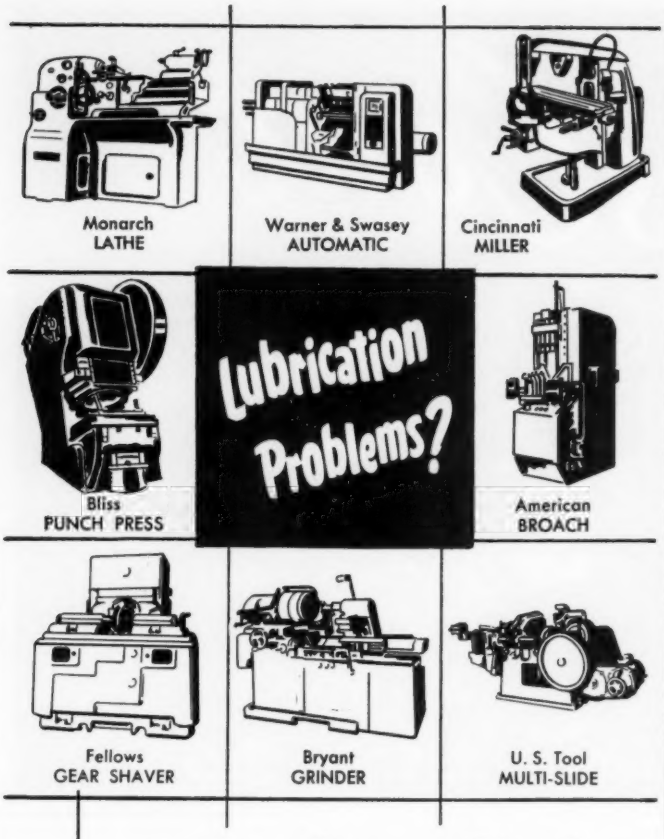

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have some special worth and ability that is not being recognized or evidenced in his present job. It is in this connection that the foreman's evaluation statement, together with the exit interview may serve the purpose of bringing these matters to light.

There is a prolific source of useful information to be unearthed by the exit interviews on employees who quit or are discharged. It is good practice for the personnel department to interview employees who leave as well as those who apply for work. Workers who leave may do so for reasons which the company would like very much to know. Valuable information may be obtained at this time on the attitude of the employees toward the company and its employment policies. The interview also serves as a check on the ability of the personnel department to select desirable workers and place them in the correct positions. In an effort to lower unnecessary labor turnover, to eliminate causes for quitting, and to foster a friendly ex-employee and public attitude toward the company, this practice has proved of real value.

It is not unusual at such a time to find real and imaginary grievances expressed against the company. Hence the interviewer must possess considerable tact in order to conduct a successful investigation and promote a friendly feeling. A personal interview with a sympathetic and helpful interviewer may bring to light the individual's secondary skills and abilities that have not been evidenced in his present position but that may be useful in his assignment to another department of the plant.

Without question, the most drastic

"Should've seen us when we climbed Mt. Everest."

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of all disciplinary measures is discharge. It was long the established therapy for all kinds of disciplinary problems. Yet it is, at the same time, one of the least satisfactory. It means, in many cases, that management loses the services of an experienced employee whose training and experience have been gained, to some extent, at management's expense. It necessitates breaking in a new worker somewhere along the line, and that process is always more or less expensive. It is frequently a source of ill-will toward management, both from the worker involved and his immediate friends and also from other employees. It may have decidedly unfortunate effects on the morale of other employees, especially if the circumstances surrounding the case are unknown or are misrepresented. Moreover with increasing legislative provisions requiring dismissal compensation and unemployment benefits, it may be directly expensive to management.

Under the circumstances, it is not surprising that managerial policies with respect to discharge have undergone comprehensive change in recent years. Whereas it was more or less customary to permit any foreman to fire at will in the past, the more common present practice is to require that responsibilty for this action shall be concentrated in the personnel department, with the "exit interview" used to assure a satisfactory arrangement. The whole point of view toward discharge regards it as a means to be utilized only as a last resort after all other possible attempts have been made to secure satisfactory cooperation and placement of the worker.

To the short-sighted foreman, the evaluation interview may seem like a difficult and unsatisfactory solution to the human problem of placing a worker where he will best fit and perhaps save a good man for another department. The foreman should remember that "there is always an easy solution to every human problem—neat, plausible and wrong."

Harry Kaufman
Philadelphia

•

SQUEAL OR SQUIRM

ANY FOREMAN or supervisor that is Johnny-on-the-job knows all the time what his men are doing. Some men are always beefing. Some men are always dogging on the job, if you don't watch them. Therefore if a foreman or supervisor is not Johnny-on-the-job he will have his hands full. But the Johnny-on-the-job

foreman trains his men to do a good day's work for a day's pay and will not tolerate anything otherwise. He will not have any trouble with the men under him. As soon as one of the men gets out of order, that is lays down on the job, the foreman will not let it go very far. He will ask the man what is the trouble right away, not delay it long. The man will fall in line and do his best. If not, the foreman will take action at once.

Some time a man will not be up to par, and if he is trained right to do his job, he will come to his boss and tell him his trouble. Then the foreman will try to help and ease up on him.

Now let's take the man that is trying to beef and he is coming to squeal on another worker about something. The foreman will politely point out to the squealer that he appreciates the fellow's interest in his job and that he knows all about it; that Riley is actually doing exactly as he was told to do; that he (the foreman) is sorry that he did not enlighten Moore of the condition of Riley which he should have done. Then Moore will see that his boss is Johnny-on-the-job and he will not come with tales or squeal.

The foreman should then thank Moore for calling it to his attention, and then call in Riley and have a heart to heart talk with him telling him that he noticed that he is not doing as he should, that he was watching him for the last few days and that he will have to buckle down and do his job, otherwise some one else will have to be put in his place.

Michael Axler
New York

NEW BOOKS

METALWORKING LUBRICANTS, THEIR SELECTION, APPLICATION, AND MAINTENANCE — *By E. L. H. Bastian, Staff Engineer, Shell Oil Company. Published by the McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 18, N. Y. 357 pages, 6x9 in. Price $6.*

Mr. Bastian has become well known for his articles and papers on lubrication and coolants through the years, and the compiling of all this and much added material in one comprehensive text is a laudable endeavor. Here, at long last, is a specialized text for Metalworking,

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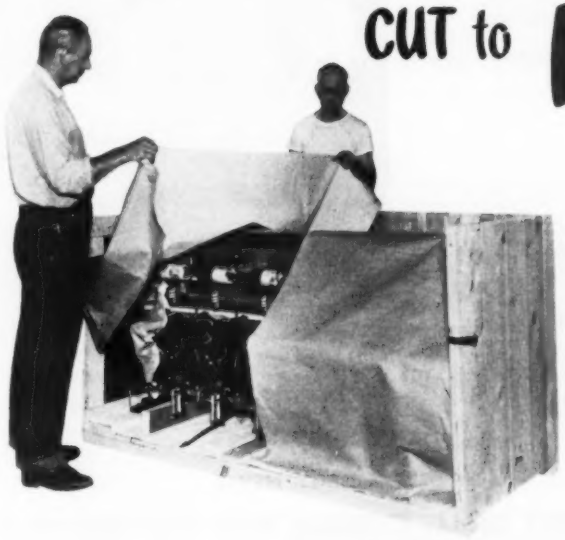

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Extensive appendixes, charts, tables, and sketches help make the text a handbook.

•

GERMAN-ENGLISH TECHNICAL DICTIONARY.—*Edited by Kurt F. Leidecker. Published by S. F. Vanni, 30 W. 12th St., New York, N. Y. In two volumes. Price $35.*

Based on data compiled by the U. S. Air Force, and containing the official translation of scientific terms found in the secret documents captured by the Allies after the fall of Germany, this unique dictionary encompasses approximately 100,000 terms. Its terminology has been adopted in the official documents of the U.S. and Great Britain, as well as by the industries of both countries.

Almost 60% of the entries are not to be found in any other dictionary, and include terminology, abbreviations, symbols and code words employed in aeronautics, rocketry, space navigation, atomic physics, jet propulsion, aeromedicine, radio, radar, electronics, and many other specialized branches of engineering and science.

"Shh - - holy Ike, I know I'm late!"

subcontracting NEWS

MACHINES TO BUILD TANK CANNON move into Firestone Tire & Rubber Company's Plant 3 in Akron, where Bofors 40mm anti-aircraft gun carriages were built in World War II. Photo shows partial installation of 160 lathes, drills and presses required to turn tubes for a new-type tank gun. The machine tools required 110 freight cars to move them into Akron from 16 government arsenals where they have been stored since the war

$5 Billion in Contracts Let As Military Rush to Clear Books

WASHINGTON — Last month saw the military sending out contracts so fast that they're not sure exactly how many were let or who got them. Reason was that all three services had some money left on the books for procurement and they had to get rid of it before the third supplemental went to Congress.

No figures are available on this yet but one procurement officer said "more contracts were let or prepared to be let than at any comparable period during the war." Best guess puts the dollar value of last month's obligating at somewhere in the vicinity of $5 billion. The trend has already dropped back to a substantially lower figure and by the end of June will be around $4 billion.

But expenditures are on the upswing. The military are beginning to shift into higher gear as far as paying out money is concerned. Expenditures for April will total about $2.3 billions for procurement. Total procurement expenditures for fiscal 1951 will go over $19 billion but will fall short of the $20 billion mark expected last winter. This figure includes both soft and hard goods.

• **All is not roses** with the military, however. Defense officials are beginning to wonder at the wisdom of negotiating so many contracts last summer, without getting tougher on producers. Deliveries on some items, particularly in soft goods, are not meeting schedules. This is true of the "off-the-shelf" items that can go to both civil and military needs. In one case contract delinquencies took a sharp jump from 15% to 35% of all contracts let for that item.

• **Another trouble** has been that some military procurement agencies put out letters of intent for manufacturers at a time when they thought they'd have supplemental funds to cover firm contracts. But the third supplemental was late in getting to Congress and had to be cut. Now the problem is where to get the money to back firm contracts until 1952 funds are available for procurement.

To Make Ammunition Component

ELGIN, Ill.—Elgin National Watch Co. will soon begin producing for the Navy a new ammunition component which the company helped develop. Tooling will begin immediately and production will start at auxiliary plant facilities here which the company closed down shortly after the second World War.

Oldsmobile Will Make Parts for Sapphire Jet

LANSING, Mich.—Oldsmobile Div. of General Motors has a new large contract to manufacture compressor and turbine units for the J-65 Sapphire Jet engine. A new plant will be erected in Lansing for operations, and about 4000 employees will be required. This is the third and largest defense assignment Oldsmobile has been given.

Buick is handling the prime contract for the complete engine. Indications are there will be some subcontracting, but not very much, from Oldsmobile on its share of the load. Assignments for blading and other requirements may likely be placed with manufacturers now producing for other phases of the jet engine program.

Westinghouse has Big Electronic Contracts

SUNBURY, Pa. — Four contracts totaling approximately $12 million for manufacture of radio test equipment, transmitting equipment, and other electronic devices for the armed forces have been awarded the Westinghouse Television and Radio Div. here.

Tooling and allocation of manufacturing space for production is now underway, and reorganization of staff duties is being arranged to make available supervision and direction of the defense program, F. M. Sloan, division manager, said.

Meanwhile, the manager reported active negotiations for additional substantial defense contracts for a variety of electronic products.

Northrop Subcontract Goes To Rheem

NEW YORK—Rheem Mfg. Company's Aircraft Div. has received a letter of intent from Northrop Aircraft, Inc., for fabrication and assembly of components for the Scorpion F-89 all-weather interceptor.

Preliminary work under the contract will start shortly at Rheem's South Gate (Calif.) plant but actual fabrication and assembly will take place at the company's new aircraft plant at nearby Downey.

'Operation Small Business' Opens In Chicago with Contractor Display

CHICAGO—Air Force "operation small business" will open at the Navy Pier here Monday, April 30, continuing to May 9. More than 50 Air Force prime contractors will display the unclassified products they are building for the Air Force and for which they want subcontractors.

Subcontractors planning to visit the exhibit should contact Midcentral Air Procurement District, 1660 East Hyde Park Blvd., Chicago.

Prime contractors already assigned booth space include: Ford Aircraft Engine Div., Chicago; Crosley Motors, Cincinnati; McDonnell Aircraft Corp., St. Louis; Hydraulic Div., Sundstrand Machine Tool Co., Rockford, Ill.; A. C. Spark Plug Div., General Motors Corp., Milwaukee; Bell & Howell Co., Chicago; Mechanical Div., General Mills, Inc., Minneapolis; Piasecki Helicopter, Niagara Falls, N.Y.; Chicago Aerial Survey; Vendo Co., St. Louis; Lear, Inc., Grand Rapids, Mich.; Hughes Aircraft Co., Los Angeles; Consolidated Radio Products Corp., Chicago; Hallicrafters Co., Chicago; Minneapolis-Honeywell Regulator Co., Minneapolis; Arnolt Motor Div., Arnolt Corp., Warsaw, Ind.; Curtiss-Wright Corp.

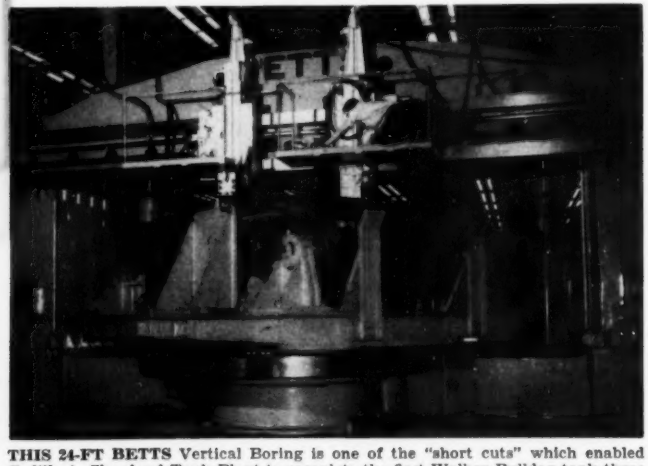
Boston Clinic to Aid Subcontracting

BOSTON—A four-day armed services procurement clinic, to stimulate subcontracting on defense production orders among smaller business in New England and the Northeast, will be held at the Commonwealth Avenue Armory, Boston, May 15-18.

More than 100 prime contractors and major subcontractors will have on display the parts and equipment which they would like to have made.

All potential subcontractors are invited to attend the clinic and discuss their production facilities and capacities with the larger contractors.

The clinic is sponsored jointly by the armed services, the New England Council, the Boston Chamber of Commerce, the Smaller Business Association of New England, the Associated Industries of Massachusetts, and the state development commissions of New England and New York state.



THIS 24-FT BETTS Vertical Boring is one of the "short cuts" which enabled Cadillac's Cleveland Tank Plant to complete the first Walker Bulldog tank three months ahead of schedule. Normally a machine big enough to grind and finish the surface on a tank hull would take one year to build. Engineers of Cadillac and Consolidated Machine & Tool Co., Rochester, N.Y., cut time and cost in half by utilizing a 12-ft boring mill and working out a way of extending the side columns to obtain 24-ft swing clearance. Additional time was saved because this expanded design also permitted use of standard 12-ft machine elements

Pontiac Will Use 500 Outside Suppliers

PONTIAC, MICH.—About 500 outside supplier companies will sell parts and assemblies to the Pontiac Motor Div. of General Motors Corp. for a new arms contract for medium caliber cannon. The contract is reported to call for about $57 million in deliveries.

The outside subcontractors will produce around 75% of the parts of the cannon. These outside subcontractors will be selected on the basis of the usual standards employed by Pontiac—price quotations, dependability of production and shipping schedules, availability of facilities, etc. Estimates are that almost 1200 components will come from outside, while Pontiac itself will build an additional 500 different pieces.

Pre-production tooling is expected to require about five months, although some of the 1250 machine tools needed for the job will come from government arsenals and warehouses.

In charge of the project is Charles L. Delorge, present motor plant assistant superintendent. He has been designated gun production superintendent. The locale of the work will be in the division's home plant at Pontiac.

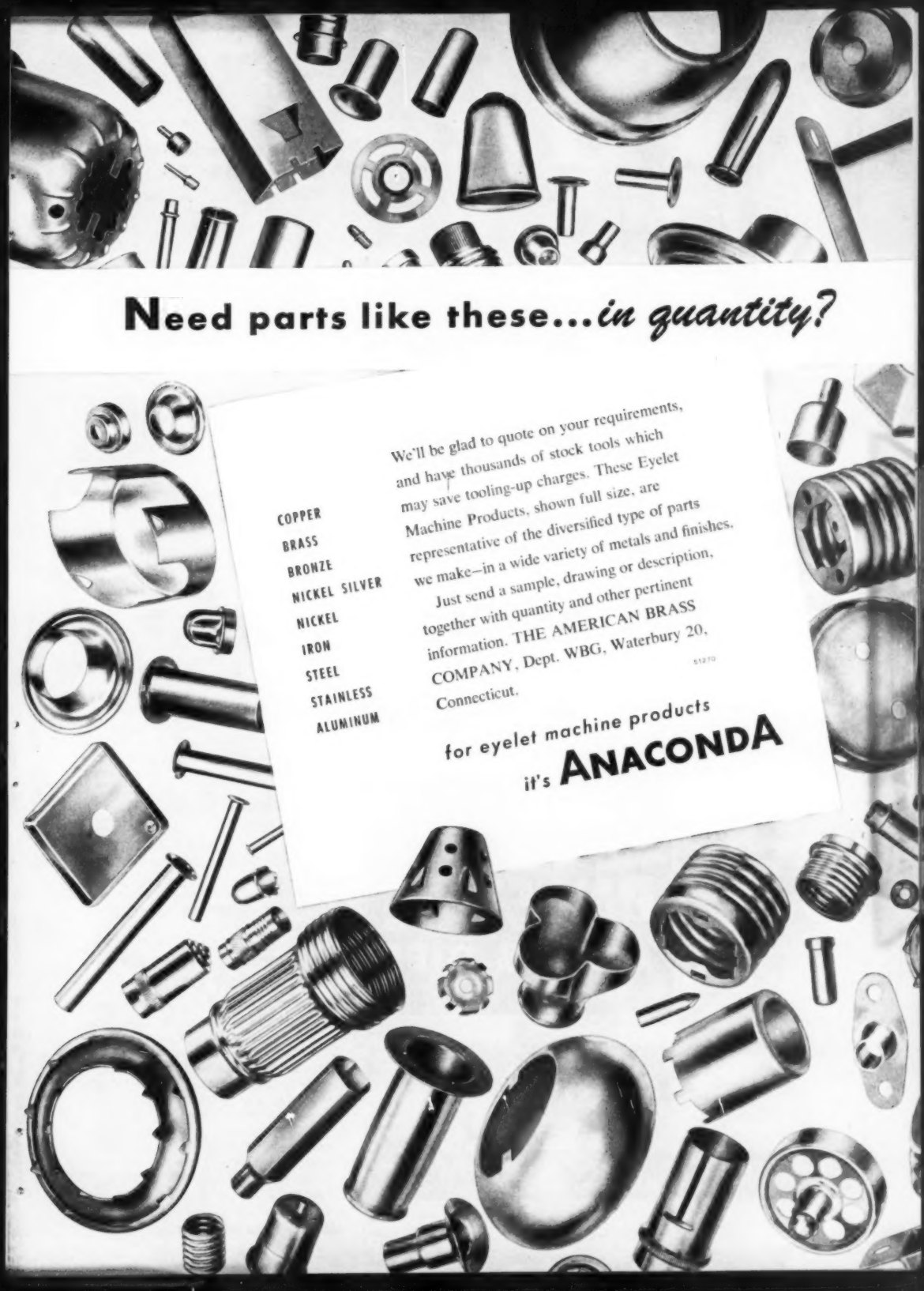
NPA Approval Needed To Produce, Use Alloys

WASHINGTON — If you produce metal alloys, sell them or use them, you'll have to get NPA approval beginning May 1. An amendment to the basic steel orders calls for advance notice of production plans. It empowers NPA to cancel orders, limit production, and dictate the use to which alloys can be put.

The program starts with producers. They will submit a monthly schedule giving orders on hand, chemical and physical properties of the products ordered, and the proposed end-use. Only producers so small that they have not been included in previous orders are exempted.

Alloys containing any of these materials are under the order; boron calcium, chromium, cobalt columbium, manganese, molybdenum, nickel, silicon, tantalum, titanium, tungsten, vanadium and zirconium.

The first melt schedules are due May 1 and will be used to direct June production.



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Defense Production Men Realigned by Pontiac

PONTIAC, Mich.—Realignment of production personnel to handle defense production of the Army rocket and amphibious vehicle projects has been announced by Pontiac Motor Div. Manufacturing manager Arlie F. Johnson has been placed in charge of all defense output, and David J. Dunlop will head automotive production, both remaining under Buel E. Starr, general manufacturing manager. G. Robert Scharf was named superintendent of the Army rocket project (days) and Paul Tabor will be superintendent of the second shift.

Roland Saterlee has been named superintendent of transmission production for the amphibious cargo carrier, and Jesse C. Hunter superintendent of assembly of the vehicle. Wm. L. Kelley, sheet metal plant superintendent, will head all sheet metal operations, both automotive and defense.

Contract for Helicopters

PALO ALTO, Calif.—Hiller Helicopters here has been awarded a new contract for construction of large quantity of military-designed H-23B air evacuation type helicopters. The second large Army order is in addition to the company's H-23A order announced last December.

The Navy Bureau of Aeronautics has placed an additional order with Hiller for a new type HTE trainer.

Tank Division Established

DEARBORN, Mich. — Ford Motor Co. has established a Tank Division with A. C. Moore as general manager. The division will be responsible for manufacture of medium tanks for the Army at a plant to be erected in Livonia, Mich.

Subcontractors, Primes Aided by Long Island Assn.

NEW YORK—A Long Island manufacturer tooled to produce aluminum screens and storm sash has been converted to making chassis for electronic units. Another company producing pre-fabricated houses was shown how to convert to wooden kits for instruments and tools.

These are but two of the companies, hit hard by materials shortages, who have been helped into defense production through efforts of the Industrial Bureau of the Long

Island Association, Garden City, N. Y. At present more than 150 manufacturers per week visit the Industrial Bureau to take advantage of the services. Purchasing agents of prime contractors in the area say that this coordination greatly simplifies their problem.

Here's how the bureau operates to bring prime and subcontractors together:

Shops seeking work send a representative to the association office. There he fills out a form based on government "invitations to bid." He describes the operations his shop can do, lists his facilities, and indicates whether his company's interest is in prime or subcontract activity.

Firms seeking facilities for subcontract placement complete a shorter form to describe the specific job to be done and its extent. Jobs described are checked against facilities available and the company looking for help is told where to find it. A telephone call to describe the job is all that is necessary.

Latest Defense Contracts Listed

ARMY ORDNANCE AWARDS

St. Louis Ordnance District

Murray Co. of Texas, Dallas—shells.
H. C. Rife, Inc., St. Louis—cable systems.
Wagner Electric Corp., St. Louis—shoe, brake and spring shaft and washer.
Progressive Service Co., St. Louis—primer, percussion.
General Motors Corp., Chevrolet Shell Div., St. Louis—shells.
Knapp-Monarch Co., St. Louis — grenade rifles.
Modern Optics Laboratory, Houston, Tex.—fire control items.
Movie Mite Corp., Kansas City, Mo.—fire control items.
Winter Weiss Co., Denver, Colo.—trailers.
Benjamin Air Rifle Co., St. Louis—fire control items.

New York Ordnance District

Ketay Mfg. Corp., New York—synchros, resolvers, 60 cycle.
S. W. Farber, Inc., Bronx, N.Y.—head metal parts for rocket, 3.5 in.
American Safety Razor Corp., Brooklyn—metal parts for fuses.

Springfield Ordnance District, Springfield, Mass.

New Haven Clock Co., New Haven, Conn.—pinion, elev., rear sight assembly.
Underwood Corp., New York—overhauling and rebuilding 400,000 carbines, .30 cal. M1.
Cuno Engineering Corp., Meriden, Conn.—components, engine oil filter.
Marlin Firearms Co., New Haven, Conn.—150,000 stock assemblies for carbine, .30 cal. M1 and M2.
Winchester Repeating Arms, New Haven, Conn.—cartridge, ball, carbine, .30 cal. M1.
Yale & Towne Mfg. Co., Stamford, Conn.—fuze, metal parts with delay plunger, M1 .05-sec delay.

Detroit Ordnance District

Pontiac Motor Div., General Motors Corp., Pontiac, Mich.—rockets, HS 4.5 in.
Ceco Gage & Tool Co., Detroit—profile and alignment gage assemblies.
King-Seeley Corp., Ann Arbor, Mich.—metal parts for primer, percussion.

Ordnance Tank-Automotive Center, Detroit

Allis-Chalmers Mfg. Co., Milwaukee—spacer, power take-off gear, low range transmission.
General Construction Corp., St. Petersburg, Fla.—stud, support, washer, rod, cross, clamp.
Donaldson Co., Inc., St. Paul, Minn.—cleaner, air engine carburetor assembly.
Automotive Supply Co., Detroit—repair kit, winch drive shaft universal joint; repair kit, universal propeller shaft.
Griffin Engineering Co., Inc., Worthington, Ind.—holder, periscope assembly.
Yale & Towne Mfg. Co., Philadelphia—hoist, chain, pull and lift type.
Buda Co., Harvey, Ill.—generator, diesel engine driven.
C. N. Monroe Mfg. Co., Flint, Mich.—track link connection.
Bendix Westinghouse Automotive Air Brake Co., Elyria, Ohio—nut ball sleeve, elbow tube compression.
Dockson Corp., Detroit—regulator, acetylene pressure, cutting and welding.
Hall-Scott Motor Div., Philadelphia—engine, complete assembly.
AC Spark Plug Div., Flint, Mich.—drive, unit speedometer electrical assembly.
Active Gear Co., Chicago—gear, transmission output clutch.
Meyers Aircraft Co., Tecumseh, Mich.—cab closure, hard top.
Toledo Scale Co., Toledo—scales, weighing, platform portable, deal type.
Biederman Motors Corp., Cincinnati—engines with accessories.
Delco Products Div., Dayton, Ohio—repair kits, shock absorber.
D. W. Onan & Sons, Inc., Minneapolis—generator, portable, gasoline engine driven.
General Motors Corp., Pontiac, Mich.—buses, integral, 38-passenger.
United Motors Service Div., General Motors Corp., Detroit—bearing sets, engine crankshaft main; generator starter, distributor, bushing, etc.
Autocar Co., Ardmore, Pa.—truck, dump, 10 to 4x2.
Trailmobile Co., Cincinnati—semi-trailer.
Northwestern Auto Parts Co., Minneapolis—yoke, fork, gasket, and gear.
Hartman Corp., St. Louis County, Mo.—jack, pneumatic, portable-car jack, pneumatic, portable-truck.

Ordnance Ammunition Center, Joliet, Ill.

Sheffield Corp., Dayton, Ohio—surface finish air gages.
Vertex Co., New York—taping machines for 105mm shells.
Hopkins Machine Corp., Chicago—machines, can closing for supplementary charges.

Picatinny Arsenal, Dover, N.J.

Wolverine Tube Div., Calumet Hecla Consolidated Copper Co., Inc., Detroit—metal parts for primer, percussion.
Ocean City Mfg. Co., Philadelphia—metal parts for primer, percussion.
National Mfg. Co., Inc., Hillside, N. J.—metal parts for percussion element assembly.
Kay Mfg. Corp., Brooklyn—spring shorting clip for rocket, practice, 3.5 in.

Watervliet Arsenal, N.Y.

Premier Textile Machinery Co., Inc., Jersey City, N.J.—parts for 81mm mortar.
Ravenna Metal Products Corp., Seattle—parts for 60mm mortar.
Greenfield Tap & Die Corp., Greenfield, Mass.—12 items of gages, adjustable limit snap.

Frankford Arsenal, Philadelphia

Bausch & Lomb Optical Co., Rochester, N.Y.—optical parts & special tooling for same.
J. L. Clark Mfg. Co., Rockford, Ill.—clips, cartridge, carbine, .30 cal.; special tooling; Parkerizing and oiling equipment.
Redco Tool, Red Lion, Pa.—sight, ring & special tooling for same.
Safety Car Heating & Lighting Co., Inc., New Haven, Conn.—spare parts for fire control instruments.
Allied Federal Screw Machine Products Co., Newark, N.J.—windshield, aluminum.
Lewin-Mathes Co., St. Louis, Mo.—G.M. rotating ban blanks.
Williard Sales & Service, Philadelphia—air conditioning units.
Aluminum Co. of America, Washington, D.C.—aluminum forgings.

ARMY ENGINEERS AWARDS

Corps of Engineers, Chicago Procurement Office

Foote Co., Nunda, N.Y.—spare parts.
Euclid Road Machinery Co., Cleveland—spare parts.
Blood Bros. Machinery Co., Allegan, Mich.—spare parts.
Galion Iron Works, Galion, Ohio—spare parts.
Holland Hitch Co., Holland, Mich.—spare parts.
Caterpillar Tractor Co., Peoria, Ill.—spare parts.
Seaman Motors, Inc., Milwaukee—mixers, rotary.
Erie Steel Construction Co., Erie, Pa.—bucket, clamshell.
Schramm, Inc., West Chester, Pa.—compressors.
Unit Crane & Shovel Corp., Milwaukee—cranes and attachments.
Baldwin-Lima-Hamilton Corp., Lima, Ohio—cranes and attachments.
Thew Shovel Co., Lorain, Ohio—cranes and attachments.
Youn Welding & Dragline Co., Baton Rouge, La.—crane attachments.
C. S. Johnson, Champaign, Ill.—crane attachments.
Pettibone-Mulliken Co., Chicago—crane attachments.
Jackson Lumber Harv. Co., Brewton, Ala.—sawmill, mobile.
Columbian Steel Tank Co., Kansas City, Mo.—steel tanks.
International Harvester Co., Melrose Park, Ill.—tractors.
Wayne Crane Div., American Steel Dredge Co., Ft. Wayne, Ind.—cranes and attachments.
Jacques Power Saw Co., Denison, Tex.—earth augers.
Galion Iron Works, Galion, Ohio—road rollers.
Schield Bantam Co., Waverly, Iowa—crane shovel with attachments.
Quickway Truck Shovel Co., Denver, Colo.—cranes and booms.
Browning Crane & Shovel Co., Cleveland—cranes and attachments.
Barber-Greene Co., Aurora, Ill.—conveyors, dryers, elevators, gradation control units.
LeTourneau, Inc., Peoria, Ill.—rooters.
LeRoi Co., Milwaukee—compressors.
Wagner Electric Corp., St. Louis—spare parts.
General Electric Co., Chicago—rack, battery charging.
Chicago Pneumatic Tool Co., New York—generator sets.

(Continued next page)

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Sales and Service in Principal Cities

ARMY ENGINEER AWARDS

. . . continued

Fairbanks Morse & Co., Chicago—generator sets.

Roller Smith Div., Realty & Industrial Corp., Bethlehem, Pa.—ammeters.

United States Motor Corp., Oshkosh, Wis.—generator sets.

OTHER ARMY AWARDS

Chicago Quartermaster Depot

Enterprise Mfg. Co. of Philadelphia—machines, meat & food chopper.

Peters-Dalton, Inc., Detroit—machines, dishwashing.

Gresham & Co., Inc., Kansas City, Mo.—machines, dishwashing.

Rieke Metal Products Corp., Auburn, Ind.—plug assembly.

Rockford Metal Products, Rockford, Ill.—plug assembly, 2 in.

Signal Corps Procurement Agency, Philadelphia

Daven Co., Newark, N. J.—signal generators.

Allen B. DuMont Laboratories, Inc., Clifton, N. J.—electron tubes.

Teletype Corp., Chicago—reperforator-transmitters.

Connecticut Telephone & Electric Corp., Meriden, Conn.—microphones.

Gray Mfg. Co., Hartford, Conn.—controls.

Leeds & Northrup Co., Philadelphia—radiosonde recorder.

Transmitter Equipment Mfg. Co., Inc.—New York—radio terminal sets.

NAVY AWARDS

Bureau of Ordnance, Washington 25, D.C.

Canister Co., Inc., Phillipsburg, N.J.—medium-caliber projectile de-fuzing machines, hydraulically operated, with power and driving units.

Electric Storage Battery Co., Washington, D.C.—2-cell storage batteries.

A. C. Gilbert Co., New Haven, Conn.—Servo motors.

Specialties, Inc., Syosset, L.I., N.Y.—research, development, limited prototype production and testing of aviation ordnance equipment.

Pittsburgh-Des Moines Steel Co., Pittsburgh—torpedo container.

Naval Gun Factory, Washington 25, D.C.

Slaysman Co., Baltimore—gears.

Condenser Service & Engineering Co., Inc., Hoboken, N.J.—machining and assembly of plates and weldments.

Bureau of Ships, Washington 25, D.C.

Air Products Inc., Allentown, Pa.—acetylene generating and charging plant.

Cleveland Diesel Engine Div., General Motors Corp.—services and material to modify diesels.

Combustion Equipment Div., Todd Shipyards Corp., Elmhurst, L.I., N.Y.—modify government-owned smoke generators.

Westinghouse Electric Corp., Washington, D.C.—nozzle diaphragm.

Worthington Pump & Machinery Corp., Harrison, N.J.—air compressors.

Warren Steam Pump Co., Inc., Warren, Mass.—pumps.

Collyer Insulated Wire Co., Pawtucket, R.I.—electric cable splicing kits.

Federal Enterprises, Inc., Chicago—horns.

Radiomarine Corp., New York—radiomarine commercial type surface search radar.

Allis-Chalmers Mfg. Co., Milwaukee — switches; motor generators.

Royal Switchboard Co., Inc., Brooklyn—generator control and distribution switchboard.

R. W. Fernstrum & Co., Menominee, Mich.—hulljacket-watercooler.

Trumbull Electric Mfg. Co., Plainville, Conn.—services for development of motor starter.

Bogue Electric Mfg. Co., Paterson, N.J.—motor generators.

Kerotest Mfg. Co., Pittsburgh—valves, plug rotary.

Western Gear Works, Seattle—windlass motor and control equipment.

Thomas C. Wilson, Inc., Long Island City, N.Y.—expanders.

Diamond Power Specialty Corp., Lancaster, Ohio—soot blower head.

Babcock & Wilcox Co., New York—tube support plates.

I.T.E. Circuit Breaker Co., Philadelphia—switchboards, forward and after.

Phelps Dodge Copper Products Corp., New York—cable, submarine.

Anaconda Wire & Cable Co., Hastings-on-Hudson, N.Y.—cable, submarine.

Jaeger Machine Co., Columbus, Ohio—winches.

Hewlett Packard Co., Palo Alto, Calif.—signal generators.

Air King Products Co., Brooklyn—wire recorders.

Litton Industries, San Carlos, Calif.—magnetrons.

National Electrical Machine Shops, Inc., Silver Spring, Md.—kit, coupling.

General Radio Co., Cambridge, Mass.—bridge, impedance.

United States Instrument Corp., Summit, N.J.—call-signal stations.

Gruendler Crusher & Pulverizer Co., St. Louis—garbage grinders.

Consolidated Diesel Electric Corp., Stamford, Conn.—diesel engine driven generating sets.

Philadelphia Naval Shipyard

Electro Dynamic Works, Electric Boat Co., Bayonne, N.J.—repair parts for H.P. air compressors.

Goulds Pumps Co., Seneca Falls, N.Y.—repair parts for pumps.

Ships Parts Control Center, Mechanicsburg, Pa.

Majestic Mfg. Co., St. Louis—repair parts for ovens.

Allis-Chalmers Mfg. Co., Milwaukee—repair parts for motors and generators; repair parts for pumps, motors, generators and control equipment.

Grinnell Co., Inc., Providence, R.I.—repair parts for valves.

Hotpoint, Inc., Chicago—repair parts for ranges.

Fischer & Carter Co., Hatboro, Pa.—indicating equipment.

Pitometer Log Corp., New York—repair parts for underwater log systems.

Operadio Mfg. Co., St. Charles, Ill.—repair parts for battle announcing and intercommunication systems.

Fram Corp., Providence, R.I.—fuel oil filter assemblies.

Naval Construction Battalion Center, Port Hueneme, Calif.

Dura Steel Products Co., Los Angeles—lavatories, double urinals, metal.

States Batteries, Inc., of San Francisco—batteries, storage, dry charged.

Caterpillar Tractor Co., Peoria, Ill.—road graders.

Dewey-Shepard Boiler Co., Inc., Peru, Ind.—boiler, steam generating.

Four Wheel Drive Pacific Co., Los Angeles—crane shovel and attachments.

Bucyrus-Erie Co., South Milwaukee, Wis.—crane shovels and attachments.

Victor Equipment Co., Los Angeles—complete welding units.

Cleveland Trencher Co.—repair parts.

Insinger Machine Co., Philadelphia—dishwashers.

Detroit Diesel Engine Div., General Motors Corp., Detroit—diesel electric generators.

Electronic Supply Office, Great Lakes, Ill.

RCA Victor Div., Radio Corp. of America, Harrison, N.J.—tubes, type 809 transmitting, triode.

Chatham Electronics Corp., Newark, N.J.—tubes, electron type, voltage regulator.

Micamold Radio Corp., Brooklyn—capacitors.

Sylvania Electric Products, Boston—electron tubes, magnetron.

Sangamo Electric Co., Springfield, Ill.—capacitors, fixed, mica dielectric.

NAVY AVIATION AWARDS

Bureau of Aeronautics, Washington 25, D.C.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N.J.—transmitter fuel flowmeters; voltage regulators.

National Pneumatic Co., Inc., Holtzer-Cabot Div., Boston—inverters.

Sperry Gyroscope Co., Great Neck, L.I., N.Y.—gyro horizon indicators.

General Electric Co., Washington, D.C.—voltage regulators.

Interstate Engineering Corp., El Segundo, Calif.—hydraulic gun chargers.

Curtiss-Wright Corp., Propeller Div., Caldwell, N.J.—propellers.

Warsaw Elevator Co., Warsaw, N.Y.—generators and regulators.

Cornell Aeronautical Laboratory, Inc., Buffalo, N.Y.—helicopter air velocity instruments with accessory equipment.

Aviation Supply Office, Philadelphia

Lear, Inc., Grand Rapids, Mich.—motors, 23 volts, direct current.

Homelite Corp., Port Chester, N. Y.—power plant assembly.

Air Associates, Inc., Teterboro, N. J.—actuator; wing flap for aircraft.

Kings Microwave Co., Tuckahoe, N. Y.—test sets.

Aeronautical Machinery Corp., c/o Nestor Johnson Mfg. Co., Chicago—jack, tail universal including AMC standard adapter.

United Mfg. Co., United Advertising Corp., New Haven, Conn.—testometer, aircraft generator.

Federal Enterprises, Inc., Chicago—horns, electrical, bulkhead mounting.

Scintilla Magneto Div., Bendix Aviation Corp., Sidney, N. Y.—generator, pulse (exciter unit); magneto assembly.

Eclipse Pioneer Div., Bendix Aviation Corp., Teterboro, N.J.—rotor assembly for use on various instruments; maintenance parts for instruments, Fluxgate used on transmitter.

Bendix Products Div., Bendix Aviation Corp., South Bend, Ind.—maintenance parts for fuel pumps, control assembly and pressurizing valve-ring assembly; aircraft carburetor assemblies, water regulators, and automatic engine control for aircraft.

Bendix Aviation Corp., Pacific Div., North Hollywood, Calif.—maintenance parts for various actuator assemblies, valves and cylinders for use on various aircraft.

Cleveland Pneumatic Tool Co., Cleveland—upper drag brace assembly for AJ-1 aircraft, strut assemblies for use on AJ-1 aircraft.

Vickers, Inc., Detroit—parts for aviation armament power unit.

Foote Brothers Gear & Machine Corp., Chicago—actuator; speed brake for F2H-2, 2P aircraft.

Graybar Electric Co., Inc., Philadelphia—horns, electrical, bulkhead mounting.

AC Spark Plug Div., General Motors Corp., Flint, Mich.—spark plugs.

Aireseareh Mfg. Co., Garrett Corp., Los Angeles—box gear for P2V-4, 5 aircraft; regulator assembly; pressure control for aircraft.

Thomas Edison Inc., West Orange, N.J.—engine unit gage for use on aircraft.

Industrial Precision Products Co., Chicago—suspension pin and link assembly for aviation armament.

Saval Div., William R. Whittaker Co., Ltd., Los Angeles—valve assembly: hydraulic, for use on various aircraft.

Pioneer Electronics Corp., Salem, Mass.—starters, glow switch and thermal switch.

Emerson Electric Mfg. Co., St. Louis—parts for aviation armament, control assembly, mechanism.

General Cable Corp., Philadelphia—telephone cable.

Detroit Gasket & Mfg. Co., Detroit—angles and channels: aluminum alloy heat treated.

Timken Roller Bearing Co., Canton, Ohio—bearings, roller, tapered, component parts, cones and cups.

Pacific Marine Supply Co., Seattle—spare parts kits for "NY" pump.

Westinghouse Electric Corp., Philadelphia—power test sets, type TA circuit analyzer, AC-portable.

Erno Machine Co., Inc., White Plains, N.Y.—solenoid.

Stewart-Warner Corp., Chicago—fittings, lubrication, pressure type.

Wm. R. Whittaker Co., Ltd., Los Angeles—valve assemblies, cabin air shut off for use on various aircraft.

AIR FORCE AWARDS

Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio

Elwood Pattern Works, Indianapolis, Inc.—projection printers.

Waco Aircraft Co., Troy, Ohio—bomb-handling slings.

Hamilton Standard Div., United Aircraft Corp., East Hartford, Conn.—propellers.

A. O. Smith Corp., Milwaukee—flash welding of titanium alloy.

General Electric Co., Schenectady, N. Y.—turbo jet engines; insulators; indicators; position indicators; mine cables.

U. S. Air Conditioning Corp., Minneapolis, Minn.—container assemblies.

Bell & Howell Co., Chicago—projector spare parts.

Formica Co., Cincinnati—pulley controls.

Lamkert Engineering Co., St. Louis—ejectors.

Eclipse Pioneer Div., Bendix Aviation Corp., Teterboro, N.J.—indicators; machine number indicators; fabrication.

New Departure Div., General Motors Corp., Bristol, Conn.—ball bearings.

Aeronautical Machinery Corp., Chicago—universal tail jacks.

Burroughs Adding Machine Co., Dayton—calculating machines.

Davey Compressor Co., Kent, Ohio—portable air compressors.

Ingersoll-Rand Co., Cincinnati—portable air compressors.

W. L. Maxson Corp., New York—ammunition feeders; amplifiers.

Aeroflex Laboratories, Inc., Long Island City, N.Y.—camera mounts.

Rheem Mfg. Co., New York—steel barrels.

United Steel Barrel Co., Philadelphia—steel barrels.

Climax Machinery Co., Indianapolis—dolly assemblies.

Gar Wood Industries, Inc., Detroit—trailer spare parts.

Lycoming-Spencer Div., Avco Mfg. Corp.—power plants.

Beaumont & Crandell, Inc., Kansas City, Mo.—aerial delivery containers.

Aircraft Radio Corp., Boonton, N.J.—radio receivers.

Republic Aviation Corp., Farmingdale, L.I., N.Y.—aircraft spare parts.

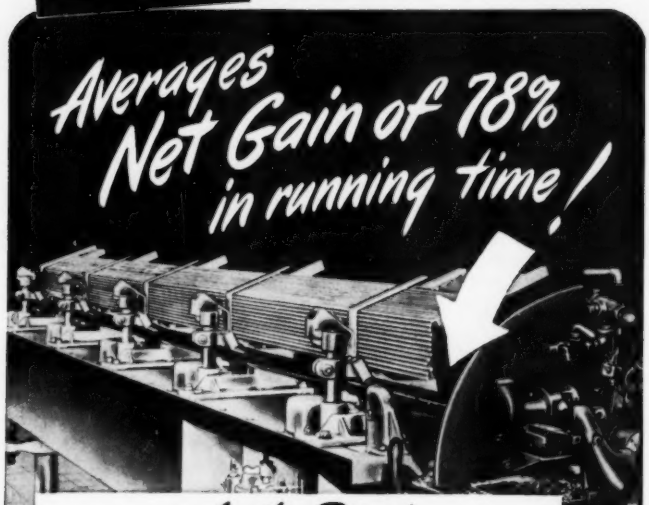
Crosley Div., Avco Mfg. Corp., Cincinnati—bomb racks.

Solar Aircraft Co., San Diego—aircraft spare parts.

U.S. Gauge Div., American Machine & Metals, Inc., Sellersville, Pa.—transmitters.

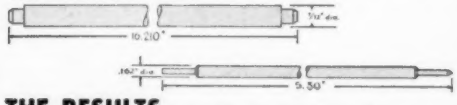
(Continued next page)

LIPE *Automatic* Magazine Loading BAR FEED



Another Record

THE JOB . . . At L. C. Smith & Corona typewriter plant, Syracuse, N. Y., such operations as cut-off, chamfering, shaping ends, knurling were done on 14 different jobs, ranging in length from 5¼" to 16¼". A Model 00 B & S Screw Machine having a Lipe Automatic Magazine Loading Bar Feed attached, was used.



THE RESULTS . . . On running time alone, a net gain of 78% was averaged over the 14 separate jobs. And that's not all! A minimum of 30% was also gained in production because the screw machine does not "cut air" when it is left running unattended by the operator. Therefore, the overall result on these widely varied jobs is an average increase in total production of 108%.

BIG Production Gains
on a great variety of work Because . . .

- *Stock is fed to screw machine all the time — not dependent upon operator.*
- *Pressure constantly behind stock.*
- *Eliminates feed fingers.*
- *Avoids multiple feed finger feed-outs.*
- *With Model AML you get maximum output of screw machine — no "cutting air."*
- *Saves in changeover set-up time.*

Upon request we will be glad to send you a time chart showing the separate savings of the 14 jobs referred to in the case history above. Get full details on how this machine will increase production and save you money. It's today's big advancement in screw machine stock feeding. Our engineers are glad to study your problem. No obligation.

LIPE ROLLWAY — *Lipe* - ROLLWAY CORPORATION, Syracuse 1, N. Y.

AIR FORCE AWARDS
. . . continued

Wilcox Electric Co., Inc., Kansas City, Mo.—transmitter assembly.
Wright Aeronautical Corp., Wood-Ridge, N.J.—shaft assembly.
Hoffman Radio Corp., Los Angeles—radio test sets.
Jack & Heintz Precision Industries, Inc., Cleveland—aircraft parts; starter assemblies.
North American Aviation, Inc., Los Angeles—airplane spare parts; miscellaneous assemblies.
Bendix Radio Div., Bendix Aviation Corp., Baltimore—radio sets; radio compass components.
Scintilla Magneto Div., Bendix Aviation Corp., Sidney, N.Y.—ignition assembly.
Bendix Products Div., Bendix Aviation Corp., South Bend, Ind.—maintenance assemblies and spare parts.
Federal Mfg. & Engrg. Corp., Brooklyn, N.Y.—radio sets.
Sperry Gyroscope Co., Great Neck, L.I., N.Y.—remote control system components; maintenance parts; microwave meters; compass system assemblies.
R. C. Allen Business Machines, Inc., Grand Rapids, Mich.—spare parts.
American LaFrance Foamite Corp., Elmira, N.Y.—fire extinguishers.
National Electronic Corp., Indianapolis—radio receivers.
Vickers, Inc., Detroit—hydraulic Pumps.
Weston Electric Instrument Corp., Newark, N.J.—indicators.
Gedro, Inc., Stamford, Conn.—reflector assembly.
Hartmen Electrical Mfg. Co., Mansfield, Ohio—generator assembly.
Stop-Fire, Inc., Brooklyn, N.Y.—fire extinguishers.
Remler Co. Ltd., San Francisco, Calif.—radio receivers.
Lundy Mfg. Corp., Long Island City, N.Y.—actuator parts.
American Metal Hose Branch, American Brass Co., Waterbury, Conn.—spare parts, assemblies.
Lewis Engineering Co., Naugatuck, Conn.—indicators.
R.B.M. Div., Essex Wire Corp., Logansport, Ind.—relays.
Wickland Mfg. Co., Pasadena, Calif.—aircraft toilets.
Kollsman Instrument Corp., Elmhurst, N.Y.—miscellaneous spare parts; indicator assemblies.
Link Aviation, Inc., Binghamton, N.Y.—misc. spare parts; trainer assemblies.
Camfield Mfg. Corp., Grand Haven, Mich.—aircraft antenna.
Eicor, Inc., Chicago—inverters.
Setchell Carlson, Inc., New Brighton, Minn.—radio receivers.
Federal Telephone & Radio Corp., Clifton, N.J.—radar sets.
Collins Radio Co., Cedar Rapids, Iowa—radio receiving sets.
Kearfott Co., Inc., Little Falls, N.J.—compass system.
Westinghouse Electric Corp., Dayton, Ohio—generators; automatic pilot assemblies; alternator assemblies.
General Electric X-Ray Corp., Milwaukee—compass systems.
U.S. Radio & Television Supplies, Inc., Chicago—capacitors.
Parker Appliance Co., Cleveland—spare parts.
Wilcox Electric Co., Inc., Kansas City, Mo.—radio set components.
Magnavox Co., Ft. Wayne, Ind.—radio compass components; control assemblies.
Fairchild Camera & Instrument Corp., Jamaica, L.I., N.Y.—radio compass components.
Pesco Div., Bedford, Ohio—fuel valve assemblies.
Simmonds Aerocessories, Inc., Tarrytown, N.Y.—spare parts.
Angell Mfg. Co., Dayton, Ohio—spare parts, bomb-rack assemblies.
Radio-Receptor Co., Brooklyn, N.Y.—blower assemblies.
Fairchild Engine Div., Fairchild Engine & Airplane Corp., Farmingdale, L.I., N.Y.—power plant assemblies.
Edicor, Inc., Chicago—inverters.
George W. Borg Corp., Equipment Div., Delavan, Wis.—navigational indicators.
Standard Electrical Products, Dayton, Ohio—relays.
DeHavilland Aircraft of Canada, Ltd., Toronto—spare parts.

*What's in Vermont this month?**

A REVOLUTION IN PRODUCTION QUALITY — AGAIN?

The first revolution in production came during the Civil War when a gunsmith found that machines can produce to close dimensions at a comparatively high rate. He demonstrated interchangeability of parts on what was considered to be a "handmade product."

Machine tool builders improved their product first to do finer work and then to do that finer work at a high production rate. Each improvement brought new products out of the handmade class into the mass production group.

During the last war countless products were mass produced on machines working to tenths. Designers took advantage of the new machines which could produce very accurate work and meet production schedules.

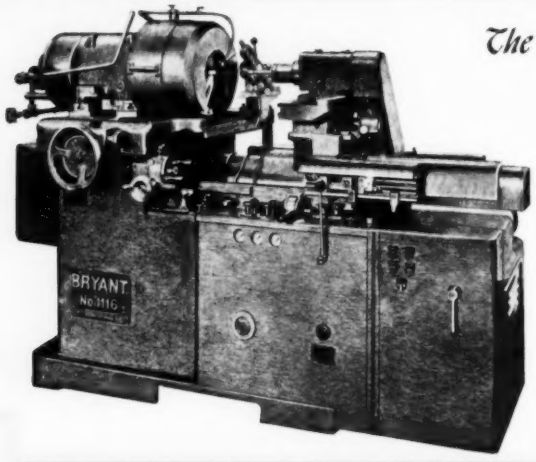
The Bryant Chucking Grinder Company of Springfield, Vermont, has built internal grinders capable of grinding holes to 10 millionths of an inch on diameter and to a surface finish of one half of one microinch. It is generally felt that such close work and such fine surface finish are beyond the needs of any present production requirements. But, should history repeat itself, these tolerances may be required from the machines of tomorrow.

Bryant Chucking Grinder Company is prepared to give you accurate figures on production rates and costs. Send your present production figures to Bryant now. We will give you data which may help you get that new machine.

* Remember . . . it won't cost to inquire!

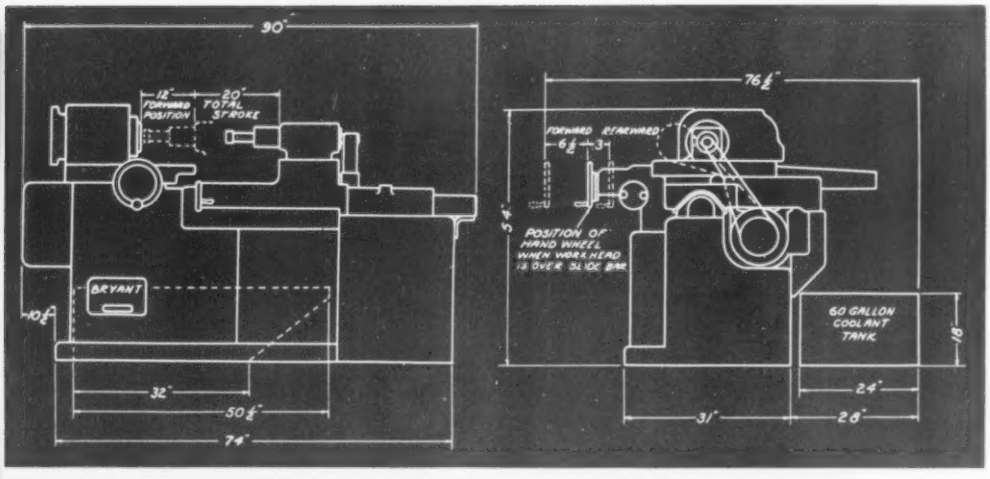
Bryant Chucking Grinder Company in Springfield, Vermont, U.S.A.

FOR HOLE GRINDING

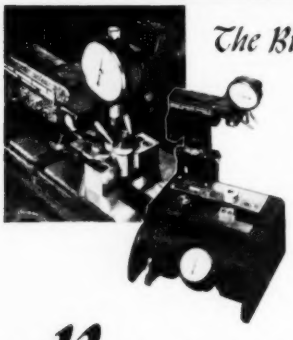


The Bryant 1116 Hydraulic Hole Grinder

This machine is for general purpose hole grinding. It has convenient centralized controls and all features necessary to handle a variety of work with minimum time and effort needed for changing jobs. For stable 3-point support, the wheel spindle is mounted on a cylindrical bar which is supported on 2 cylindrical bearings. The rear of the slide is supported on a hardened and ground guide plate. Workhead may be swiveled for grinding tapers up to 90° included angle. Provision is made for mounting a face grinding spindle in addition to the hole grinding spindle. The No. 1116 will swing 16" with 8" max. hole depth. Write for folder.



FACE SQUARE WITH INTERNAL THREAD



The Bryant Thread Gage with Squareness-of-Face Attachment

When a face must be checked square with an internal thread, the part should be held on the thread flank and rotated in this position. The Bryant Gage does this, regardless of variation in roundness, P.D., lead or thread form. The squareness-of-face indicator is raised by a yoke at a constant rate regardless of face run-out, thus giving a direct and exact reading of squareness with the thread axis. Simultaneous readings can be made — the Bryant Gage checks thread size — the Attachment shows face run-out.

Bryant Thread Gage gives accumulated reading of P.D., form and lead on dial indicator 4 to 5 times faster than plug gaging!

Bryant Chucking Grinder Company in Springfield, Vermont, U.S.A.

To heat treat *BETTER* and *FASTER*, have the *BEST* of furnaces

World's Leading Controlled-Atmosphere Furnaces by the oldest Makers of Electric Furnaces

"Certain Curtain" furnaces plus Hayes' Research Lab and Know-how . . . an unbeatable combination assuring you completely dependable results at minimum cost. There is no substitute for the BEST, to speed today's urgently needed heat-treating production, protect against spoilage, and yield the very finest work that can be produced.

REQUEST CATALOG describing the famous "Certain Curtain" line of furnaces and atmosphere generators for hardening, annealing, brazing, soldering, sintering, tempering, carbonitriding, bright heat treatment of stainless steel, etc.

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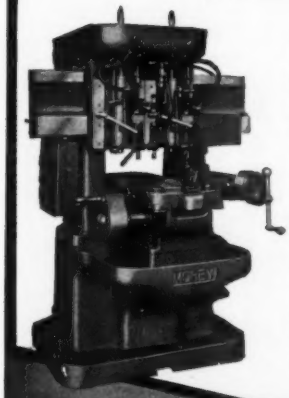

Over 2000 Morey Profilers in continuous service assuring speedy production for the United Nations in duplicating small parts.

Cross head is balanced on vibration-free cross rail . . . Clearance between spindle and table easily increased or decreased . . . Spindles mounted on precision bearings . . . Ball bearings throughout . . . Slides ride on scraped ways and are adjustable against future wear.

Ample provision for lubrication . . . Simple adjustment takes up backlash . . . No chatter marks on work . . .

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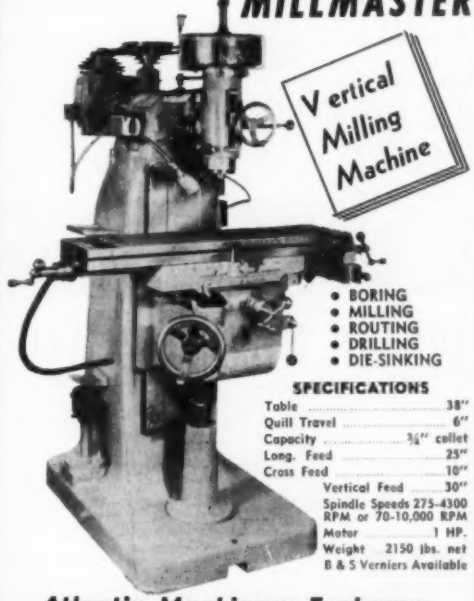

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SPECIFICATIONS

Table	38"
Quill Travel	6"
Capacity	¾" collet
Long. Feed	25"
Cross Feed	10"
Vertical Feed	30"
Spindle Speeds	275-4300 RPM or 70-10,000 RPM
Motor	1 HP.
Weight	2150 lbs. net

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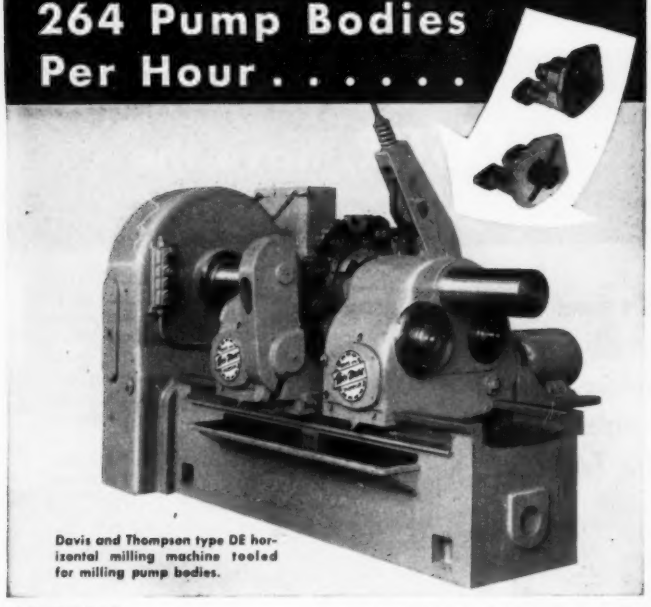
264 Pump Bodies Per Hour . . . . . .



Davis and Thompson type DE horizontal milling machine tooled for milling pump bodies.

1-A Standard Horizontal Milling Machine

Oil pump bodies requiring high degree of finish and high production are rough and finish milled on both sides simultaneously with this Davis and Thompson type DE milling machine. Production is 264 pieces per hour.

Patented Angular Spindle Adjustment Allows "Toe Cutting"—Maintains Fine Finish at High Production

The finishing spindle is provided with an exclusive D&T design which allows angular adjustment. This in turn results in "toe-cutting" and eliminates "drag" of the cutter over the finished surface. Both roughing and finishing spindles have micrometer endwise adjustment.

A Basically Standard Machine Employing Roto-Matic Principle For High Production Special Milling

Like all D&T machines this model DE is designed for long life and trouble-free operation. Each head has independent drive. There is backleash take up to mandrel. Anti-friction bearings throughout. Rapid traverse between cuts can be incorporated.

Free Data will be furnished upon request.

DAVIS and THOMPSON Roto-Matic

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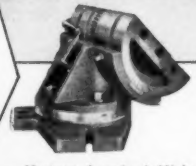
BOSTON UNIVERSAL ANGLE PLATE

A Precision Tool that Holds Work at Any Desired Angle.



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Horizontal motion is 360 degrees; vertical motion, 120 degrees. Fitted with vernier scale reading to 5 minutes.

Made in several stock sizes.

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L&I Reamers 1/16" thru 1½" by 64ths are standard and are carried in stock. Sizes thru 5/16" are ground from the solid after hardening for dimensional stability. Grinding of both faces provides finer cutting edges, permits faster feeding and keeps resharpenings to a minimum. Flutes are ground for easy chip removal.

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Letter, Wire Gage and Fractional Size Reamers are available in sturdy folding metal cases. Write for catalog or see your L&I Distributor.

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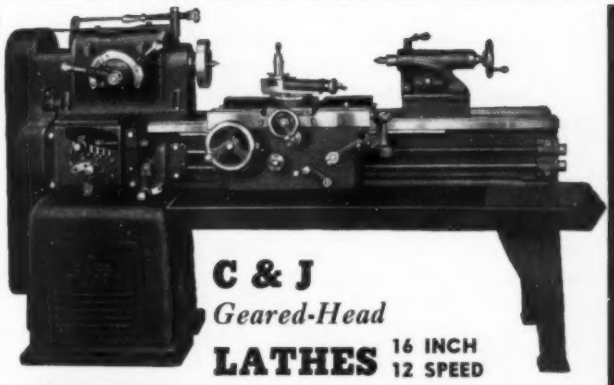

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1⅜" Hole thru spindle
11¼" Swing
56" Bed

Just as every army needs its machine guns and bazookas to complement its heavy equipment, every shop needs one or more of these light, fast, easy to operate precision lathes. There are many jobs that can be done faster, at lower cost, and with less experienced operators, on Sheldon Lathes, than on more cumbersome, more costly-machine tools.

With extra collet capacity for size, "Zero Precision" Tapered Roller Bearings, more power at the spindle than other "small" lathes, and rigidity based on scientific placement of metal rather than cumbersome mass, these moderate priced lathes are money makers. Just as "bazooka" has the hitting power of much heavier and costly armament, the modern little lathes have the earning power of much big equipment.

They are modern tools you should be familiar with, for they cut cost and increase profits in many ways.

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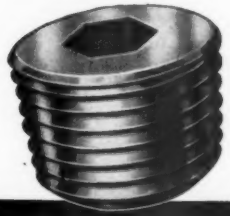

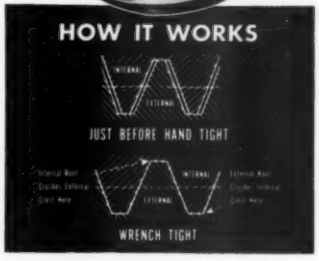

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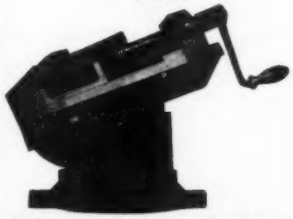

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on intricate, angular set-ups

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OPTIONAL ACCESSORY

Platen, interchangeable with vise. Increases capacity of unit. Uses: as plain platen, multi-swivel platen.

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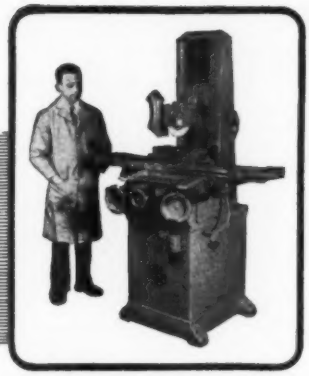

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	Stamford	Stamford 4-1164	North Carolina	Charlotte	3-1921
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Missouri	Kansas City	Victor 1336	Wisconsin	Milwaukee	West 3-4920
	St. Louis	Central 0083	Quebec, Canada	Montreal	University 2851
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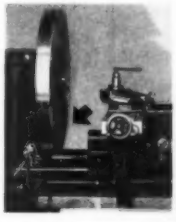

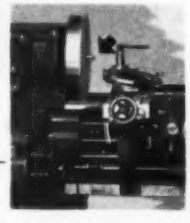

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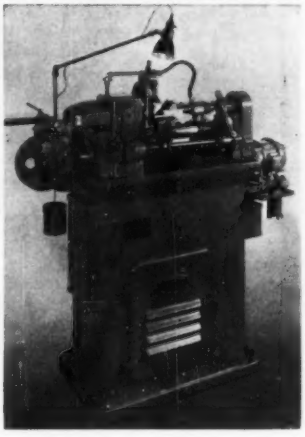

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Designed and built in Germany to high precision standards . . . thousands in use in all industrial countries

Maximum Collet Capacity:

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MODEL A-20: 13/16"
MODEL A-25: 1"
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PARTS PRODUCED — ACTUAL SIZE

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190 pieces per hour

BRASS
1200 pieces per hour

BRASS
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A versatile Machine Tool for high speed Forming, Turning, Drilling and Threading • 12 spindle speeds to 6500 R.P.M. and faster • Longitudinal turning with single point tool up to 2¾" length • Easily set-up, quick tool changes for runs as short as 500 pieces • Cam Blanks and Spare Parts.

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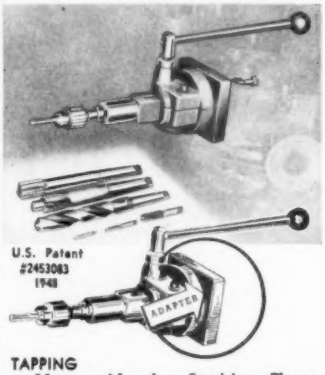
Stop tool breakage and material spoilage

caused by drag and jerkiness on turrets and large lathes



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Now, with the Sensitive Turret Attachment, you can cut fine threads from 10/32 to 4" threads with a feel that will allow you to engage without jamming and back off without stripping. More than pays for itself by saving taps and material. One user, who formerly had up to 90% rejects, now reports 100% threads on bronze with a .519-27th tap — same operator using the same late #5 turret.

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Sensitive feel eliminates breakage of center tools.

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REAMING
Reamers cut properly leaving smooth bore.

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FIVE SIZES
Direct mounting for most turrets — adapters for others.
Models for lathes.

Write today for catalog and prices — give make of machine.

Williams & Hussey
MACHINE CORP.
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MOREY TURRET LATHES

for BAR or CHUCKING { UNIVERSAL or PLAIN

3 UNIVERSAL

For bar stock up to 1½" in diameter
10" turning length
16½" swing over bed
Infinite spindle speeds: 55 to 1800 RPM.
constant speed motor, 1200 RPM
AVAILABLE ALSO WITH PLAIN CROSS SLIDE
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For bar stock up to 1" in diameter
Turning length 6½"
Swing over cross slide 6"
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Infinite spindle speeds:
Minimum of 60 RPM.
Maximum of 2000 RPM.
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THE DESIGN OF THE MOREY No. 2, 3 and 4 TURRET LATHES ARE BASICALLY ALIKE. EACH MACHINE IS ENGINEERED FOR THE SIZE WORK IT IS DESIGNED TO HANDLE.

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REMEMBER that human problems need careful study just as do engineering problems. Man is multi-motivated and one prescription won't cure all his ills.

BE suspicious of any figures you hear, and of most of those you see. If they don't correspond immediately to your previous experience, check 'em before you quote or use 'em. The urge to make numbers bigger, or smaller than anything previously reported is overpowering to some people; don't be victimized.

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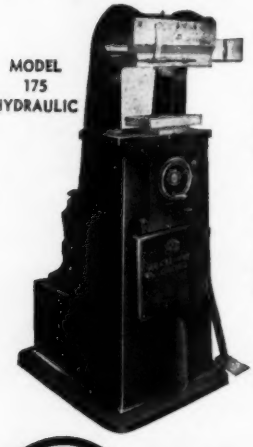

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Hack Saw blade above has been permanently marked in a Model 175 Hydraulic Marking Machine using a solid engraved lettering knurl.

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ENTIRE PUMP AND TANK UNIT ROLLS OUT ON WHEELS
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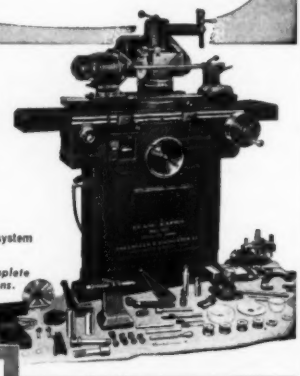

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Your letter will bring you complete information and specifications.

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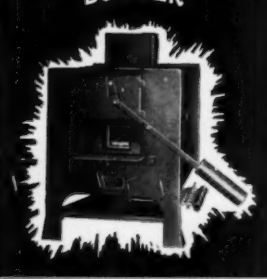

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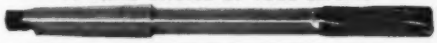

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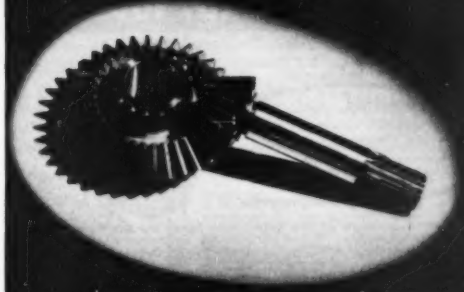

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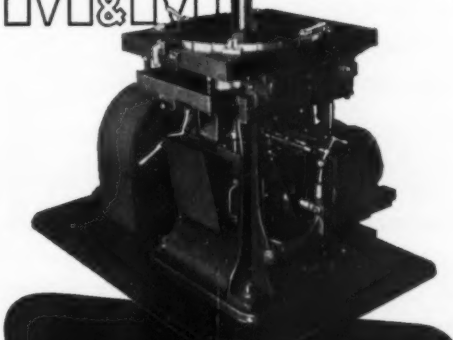

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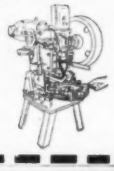

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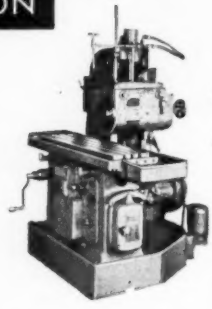

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WELDER, Federal #712 AT Motor Driven Toggle Action Projection. New in 1938. 200 KVA. 10" throat. Stroke—1" to 2". With controls.

WELDER, Federal #624B Hvy. Duty Grd. Type 75 KVA 1½" Stroke. 17" throat. Motor driven.

PRESSES

300 ton Clearing Crankless, New 1942, 12" stroke, air cushion, Model F-1300-42.

180 ton Cleveland, New 1942, 18" stroke, Model #14-S.

Abrasive Cutoff, #213 Campbell, 7½ H.P., late.
Bending Roll, 8' x ½" Newbold, pinch, all steel, 1940.
Boring Mill, #32 Lucas 4" bar, table type.
Boring Mill, #0 Giddings & Lewis, 3", horiz.
Boring Mill, 72" Betts, vertical, 2 hds.
Boring Mill, 60 Gisholt, vertical, 2 hds.
Boring Mill, 44" Bullard Maxi-Mill, Vert. PRT, M.D.
Drill, 4 spindle, #2 KH Allen, ½" chucks, late.
Drill, 3 spindle, #2MS Leland Gifford, Mtr. Spdles.
Drill, Radial, 6' N-B-P "Rightline" M. on arm.
Gear Hobber, #36H Gould & Eberhardt univ.
Gear Lapper, Type 7LS Fellows, 1942.
Grinder, #212 Besly Horiz. Opposed Disc, late.
Grinder, Surface, #34 Abrasive Vert., '41.
Grinder, #5 Bryant, internal, late.
Lapper, #10-U Norton, vert., 1941.
Lathe, Duomatic, #3A Lodge & Shipley, 51" c.c., 1942.
Lathe, 54" x 20' Johnson, taper, M.D.
Lathe, 24" x 10' American, taper, grd. hd.
Lathe, 24" x 9' c.c. Reed-Prentice, grd. hd.
Lathe, 16" x 8' American, taper, M. in base.

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Lathe, Automatic, 12" x 21" Fay, 1940.
Lathe, Automatic, 12" x 24" Lipe-Carbo.
Lathe, 68" x 24' Niles, grd. hd., M.D.
Lathe, 36" x 30' Putnam, grd. hd., M.D.
Lathe, Gap, 19"/38" x 10' c.c. LeBlond, Timken.
Lathe, 16" x 6' South Bend, late
Miller, Prod., #000 Brown & Sharpe, 1942.
Miller, Vertical, #14 Cochrane Bly, slot. attach.
Planer, 36" x 36" x 12' Cincinnati, 2 hds., M.D.
Planer, 42" x 42" x 16' Gray, 3 hds., M.D.
Press, #6G Federal, 65 ton, OBI, 1951.
Turret Lathe, #2G Morey, bar, collets, 1942.
Turret Lathe, #2 Bardon & Oliver, 1943.
Welder, 50 KVA Acme air-press, spot, timer, late.

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Lucas #43 Precision Boring Mill, 5" Bar. Table 36"x72", 16 speeds. A.C. M.D.

Norton Hyprolap #26, A.C. M.D.

Pratt & Whitney 14"x36" Surface Grinder New 1943

Ingersoll 24"x36"x18' Four Head Planer Type Miller with Slabbing Spindle, M.D.

Gorton #3L Three Dimensional Pantograph 1942 A.C. M.D.

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MODERN MACHINES

#40 Landis Floor Type Horizontal Boring Mill
#35 Landis Floor Type Horizontal Boring Mill
#25A Heald Rotary Surface Grinder
16-Y-28 Bryant Internal Grinder
#06 Cincinnati Miller
36"x36"x18' Cleveland Opensides Planer
6-D Potter & Johnston Automatic Chucking Machine
#35 Excello Thread Grinder
#61A Fellows Gear Shaper

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ANGLE ROLLS, 2"x2"x¼" H. & W., '42
BOLT THREADER, 1½" Williams Reliance
BORING MILLS, 100" & 60" Cincl., 2 Hds., P.R.T.
BORING MILLS, 3½" & 4" bar Landis Floor (3)
BORE-HONE, Barnes, 10 stroke, 6" bore, '42
BRASS LATHE, 21" Acme, Late, Hardened Ways
RADIAL, 5'12" col. Amer. Trip. Purp., M-on-arm
DRILL, 28" Colburn No. 6, 3" capty. 15 H.P., AC
DRILL, 25" Weigel, Tapping, M.D.
DRILL, 24" Colburn #14, Comp. Tble. 2" capty.
GEAR GENERATOR, 3" Gleason, Late
GEAR HOBBER, 36H Gould & Eberhardt
GEAR HOBBER, #12 Barber Coleman
GEAR PLANER, "11" Rienecker, Bevel
GEAR SHAPER, No. 25 Fellows High Speed 61A, 64 & 64A, 6 Fellows
GRINDERS, 20"x120" Landis, Cyl., Hyd., AC
GRINDER, 16"x48" Cinc. Cyl., M.D.
GRINDER, No. 6-T Sellers, Tool, '42
GRINDER, No. 16Y2B Bryant, Int., 1943
GRINDER, No. 174 Heald Gap, Int. 54" sw., '42
GRINDER, No. 72A5 Heald Internal, 1943
GRINDER, No. 75A Heald, Int. Hand Feed
GRINDER, Micro-Internal, Large
GRINDER, SURFACE, 13"x48" Hancett Vert. Spin; No. 16 Blanchard, 26" Chuck
GRINDER, UNIV. 12"x36" Thompson M.D.
LATHES, 50"x15' Cen. Niles, blocks to 60", M.D.
48"x20'6" cen. Simmons, like new, '42
LATHE, 42"x31' cen. Putnam Grd. Hd.
32"x25' cen. Sommerfeld, 2 T.A., 2 carr., '42
24"x12' bed L. & S., Modern Timken Spin.
22"x24¾"x48" cen. Skoda, New
20"x48" cen. American, T.A., (2)
No. 16 LeBlond Pro. 20" sw. x 36" cen.
TAPPERS, Nos. 1 & 2 Bakewell (4)
TURRET LA., 26" Libby "C" 4½" capty.
No. 1B Foster Univ., 2" capty. (2)
No. 2B Foster Univ. 3½" capty. Bar.
RIGID-MIL, 96" Sundstrand, Tble. 30"x120"
THREAD MILLER, 12"x60" Morey Shields, '42
MILLER, UNIV., No. 2A B. & S., M. in base, Timken Nos. 2 & 3 Cincl. Pl. Cone Motorized
MILLER, VERT., No. 4 Cincl. Hi Power, M.D.
MILLER, HORIZ., No. 2 Stand. K.&T., M-in-base
NIBBLER, 36" Gray-Savage #236
PIPE THREADER, 2" Landis, AC, M.D.
PLANER, 48"x36"x8' Cincl. 4 Hd., Box, PRT, Force Feed
SHAPERS, 24", 20" & 18" G. & E., AC, M.D.
22" & 18" Hercules, Univ., New
36" Morton, Draw-Cut M.D.
SLOTTER, 20"x24" Dill, M.D.

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Latest Types — Guaranteed Machine Tools 1941-1950 Models

BORING MACHINES—PRECISION

BARNES: No. 412 Horizontal, 60" travel

BROACHING MACHINES

CINCINNATI: 2-36 Vertical Broach

CAM MILLERS & GRINDERS

SUNDSTRAND: #36 Double Head Miller for cylindrical cams
VAN NORMAN: Contour Miller 10CT
MOREY: 12M 2-Spindle Profiler, 12¾"x15" table
HEALD: 172 Sizematic Grinder for cylindrical cams

DRILLING MACHINES

AVEY: No. 2 Deep Hole Drill, 16" stroke—hydraulic
LELAND-GIFFORD: No. 2LMS Deep Hole
BARNES: 2011¼ 2-spindle on 3-spindle base
BAKER: 30HO 2-spindle inverted, hydraulic, deep hole
BAKER: 217 Upright Heavy Duty
FOSDICK: No. 4BM Upright, High Speed
PROVIDENCE ENG.: FV-6 Sensitive 6-Spindle, ⅜" capacity
PRATT & WHITNEY: ½B x 50 Deep Hole Reamer
ALLEN: #2 High Speed
ARCHDALE: Radial, all sizes (New)
WALKER-TURNER: D950, ½" capacity, bench type (new)

ENGRAVING MACHINES

DECKEL type—3 dimensional, (New)
GORTON: 3U & 3Z, 2 dimensional
GORTON: 3B, 3 dimensional

GEAR CUTTING MACHINES

BARBER-COLMAN: No. 3 Hobber
BROWN & SHARPE: No. 8 Gear Cutter 72" diameter, 1¾ D.P.
FELLOWS: 61A, 64A, 6Z2, 7 and 72 Shapers
FELLOWS: 61, 35" capacity
FELLOWS: Straight Line Generator
GLEASON: #12 Rough & Finish Generator
GLEASON: 3" Straight Bevel Gear
GOULD & EBERHARDT: 36BM Cutter
HAMILTON: No. 1 Hobber, 6" diameter
SYKES: Gear Shaper 14" external, 20" internal
SYKES: Rack Cutting Machine 24"

GEAR FINISHERS & TESTERS

FELLOWS: 8LSI and 13 LSI Gear Lappers. External & Internal. Spur and Helical
FELLOWS: No. 12-C Spacing Tester
GLEASON: No. 13 Universal Tester
GLEASON: No. 4 and No. 6 Bevel Gear Testers, Hand and Power Operated
GLEASON: 3" Bevel Gear Tester
ILLINOIS: 514 Center distance & Concentricity Checker.
ILLINOIS: 604 Bevel Gear Hand Rolling Fixture.

GEAR & SPLINE GRINDERS

PRATT & WHITNEY: 10" single and double wheel
GEAR GRIND MACH.: GG-18, 10"x24" Hydr. Spur Gears and Splines, also Internal
GLEASON: No. 17 Spiral, Zerol, and Hypoid, capacity 23½ P.D.

GRINDERS—CYLINDRICAL

BROWN & SHARPE: No. 10, capacity 6"x 18" Plain
BROWN & SHARPE: No. 23, capacity 10"x 48", Plain
CINCINNATI: 6"x18" Hydraulic
CINCINNATI: 10"x36" Hydraulic
LANDIS: 18"x18" "C" Plain Hydraulic
LANDIS: 18"x32" Type "D" Crankpin, Hydraulic
VAN NORMAN: #866 Crankshaft Regrinder
NORTON: 6"x18" & 10"x18"
NORTON: 10"x18" 45° angle wheel head

GRINDERS—GEAR & SPLINE

PRATT & WHITNEY: 10" single and double wheel, hydraulic
GEAR GRIND MACH.: GG-18, 10"x24" Hydr. Spur Gears and Splines, also Internal
GLEASON: No. 17 Spiral, Zerol & Hypoid, capacity 23½ P.D.

GRINDERS—INTERNAL

BRYANT: No. 5Y Internal
BRYANT: 112 Universal, Hydraulic
BRYANT: 16C16 Hole, Hydraulic
HEALD: 70A Plain
HEALD: 72A3, 72A5 Plain and Univ.
HEALD: 72A3 Sizematic Centerless
HEALD: 72A5 T-bed, Universal
HEALD: 172 Sizematic for cyl. cams
RIVETT: No. 104 Tool Room

GRINDERS—RADIUS

VAN NORMAN: No. 73, 639, 649
VAN NORMAN: No. 3½ Universal

GRINDERS—SURFACE

ARTER: A-1—8" Rotary
ARTER: A-3—12" Rotary
THOMPSON: 8"x12"x18" Type B
HEALD: 8" Rotary
HEALD: No. 22 Rotary—12" Chuck
GARDNER: 120A Opposed Head Disc, 20" dia. abrasive wheels and 34 "dia. rotary work carrier.

GRINDERS—THREAD

EXCELLO: No. 31 external, dia. 5"x18" centers.
EXCELLO: No. 33 external, dia. 8"x18" centers.
JONES & LAMSON: TG-1245 External, 12"x 45"

HONING MACHINES

BARNES: No. 306H Vertical, 25" stroke
MICROMATIC: H-510 Double End Horizontal
MICROMATIC: H-2 Single End Horizontal, 2-spindle, ¼" to 1" dia. capacity.

LAPPING MACHINES

FELLOWS: 8LS1 and 13LS1 Gear Lappers
NORTON: No. 36 Hyprolaps
NORTON: No. 2F x 40" Diameter
SCHRANER: Model A External Cylindrical Lapper—6 heads.

LATHES—PRODUCTION

LIPE-ROLLWAY: 15"x30" Carbomatic, Hydraulic
LODGE & SHIPLEY: No. 3A Duomatic
MICHIGAN: #1708 and 1712 Relieving
BLOUNT: H8 Polishing, 12"x48"
WILLSON: 15"x48" Geared Head Motor Driven (New)

LATHES—TURRET

BULLARD: 24", 36" Vertical
WEBSTER & BENNETT: Vertical Turret Lathes, 36" and 48" diameter (New)
GISHOLT: #2L Saddle Type, Extended bed, 24"
HERBERT: Turret Lathes, all sizes (New)

MILLING MACHINES

CINCINNATI: 2-spindle Vertical Hydrotel with two rotary tables
CINCINNATI: No. 2M Vertical, Rotary table with power feed, 20" diameter; 10½"x52" rectangular table
CINCINNATI: 0-8 Vertical
CINCINNATI: No. 4 Vertical
REED-PRENTICE: #5 Vertical 16"x60" table
SUNDSTRAND: 98 Rigidmil-Duplex (for milling cam tracks in propeller hubs or similar)
SUNDSTRAND: Nos. 0 and 00 Rigidmil
MOREY: 12M 2-spindle Profiler, 12¾"x15" table
TAYLOR-FENN: M-80 Duplex Spline
TAYLOR-FENN: Vertical 8"x21" table with power feed
RICE-BARTON: Duplex Spline
VAN NORMAN: Contour Miller 10CT

SAWS & CUT-OFF MACHINES

MOTCH & MERRYWEATHER: No. 3 Circular Saw
TANNEWITZ: GH-36 Band Saw
RUSSELL: 9½" cut-off Saw with Auto. Stock Feed (New)
CAMPBELL: No. 425 Cutalator Abrasive Cut-Off, 4½" dia. capacity
WILLIAMS: 10" Pipe & Tube Cut-Off

THREAD MILLERS & TAPPERS

HALL PLANETARY: Model D Thread
LEES-BRADNER: LT 8"x36" Thread
LEES-BRADNER: 40A Thread Miller
MOREY: 12"x60" Thread Miller
MURCHEY: No. 22 Tapper, Horizontal, ½" to 2½" capacity
NATCO: Vert. Tapper 18 spindle
PRODUCTO: Hand Tapper

TOOL SHARPENERS

OLIVER: 2A Face Mill Grinder
OLIVER: 510 Drill Sharpener
OLIVER: 10" Tool Bit-Template
FELLOWS: Flat Top Helical Gear Cutter
RANSOM: 2-Wheel Grinder 3 HP
RUSSELL: 40" Saw Sharpener (New), Automatic Indexing
WALKER-TURNER: Bench Grinder ½ HP

MISCELLANEOUS

BAR POINTER & CHAMFER: Kent 3¼"
BAND SAW: Tannewitz, GH-36" Capacity
CUT-OFF: Campbell, Abrasive 425 Cutalator 4½" dia. capacity
CUT-OFF: Pipe & Tube, 10" Williams
DIE SINKER: Reed Prentice No. 5, 16"x60" Table
GRINDER: Walker Turner ½ HP Bench Type
LATHES: Blount Polishing 12"x48"
PRESS: Screw, Gen. Elec. 3 ton
RACK CUTTING MACHINE: Sykes 24"
RIVETER: Gen. Engr. 24" throat
TEST STAND: Denison 918-AM Hydraulic
SHAPER: 16/20" Edgwick (New)
PUNCH SHAPER: Sentinel Shrewsbury (New)

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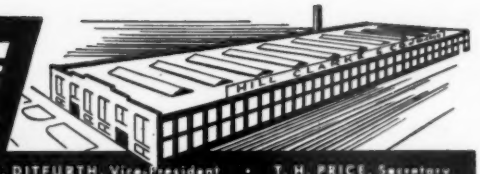

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1 Spdl—26" Sw—No. 2 LMS L.G. Hyd.
2 Spdl—24" Sw—No. 2 Avey matic
3 Spdl—15" Sw—No. 2—MA 8—Avey
4 Spdl—24" Sw—No. 3 Avey
6 Spdl—14" Sw—No. 2 LMS L.G. Hyd.

GEAR MACHINES

No. 61-A Fellows Gear Shaper (1942)
No. 7 Fellows Gear Shaper (1942)
No. 72 Fellows Gear Shaper
11" Gleason Bevel Gear Generator
12" Gleason Bevel Gear Generator
No. 13 Brown & Sharpe Spur & Bevel
No. 1 Whiton Auto. Gear Cutter
No. 6 Gleason Bevel Gear Tester (1942)
No. 2—36" Schuchardt & Schutte

BORING MACHINES

Rockford—3½" Bar
34" King Vert. Bor. Mill

GRINDERS

6"x18" Norton Type C Plain (1942)
8"x30" Norton Type C Plain (1943)
10"x36" Norton Type C (1943)
10"x72" Landis Type C Hydraulic
Hill-Clarke Norton Type Motor Driven Grinders
10"x36" centers
10"x50" centers
10"x72" centers
10"x96" centers
14"x36" centers
14"x72" centers
14"x120" centers
16"-40" gap x 120" centers
18"x96" centers
18"-30" Gap x 96" centers
20"x96" centers
23"x36" centers
24"-32" Gap x 144" centers
No. 25-A Heald Surface Grinder
No. 104 Rivett Internal Gdr. (1943)
No. 5 Bryant Internal Grd.
No. 72-A-5 Heald Internal (1942)
No. 72-A-5 Heald Extended Bridge Internal
No. 16-16 Bryant Internal Grd.
No. 16-28 Bryant Internal Grd.
No. 24-36 Bryant Internal Grd.
No. 81 Heald Centerless Internal

LATHES

Model R-14 Seneca Falls Lo-Swing

MILLING MACHINES

No. 3 Cincinnati H.P. Universal
No. 3B Milwaukee Plain
No. 4 Cincinnati H.P. Plain
No. 5 Cincinnati H.P. Plain
No. 0B Cincinnati Plain
No. 0B Cincinnati Vert.
No. 2½-B Milwaukee Vert
No. 2—18" Sundstrand-Electromil (1942)
No. 2—24" Sundstrand-Electromil (1942)
No. 4—48 Cincinnati Hyd.—2 Vert. Hds.
No. 4-48 Cincinnati Hyd. Tracer (1942)
No. 45-48 Cin. Hyd. Tracer (1941)
4"x9" Hanson Whitney Thrd. Mill
6"x36" Lees-Bradner—Model LT (1943)
6"x80" Pratt & Whitney Thrd. Mill
6"x132" Pratt & Whitney Thrd. Mill
6"x180" Pratt & Whitney Thrd. Mill
10"x48" Hanson-Whitney Thread (1942)
10"x60" Pratt & Whitney Thrd. Mill
12"x54" H.T. Lees-Bradner Thread Miller (1943)
48"x24"x12' Ingersoll Slab Miller, 4 Hds.

MISCELLANEOUS

15" Dill Slotter
18" Dill Slotter
38" Morton Draw-Cut Shaper (1945)
18" Newton Slotter
10"x10" Rassmussen Saw, Stock Fd.
No. 0 Bakewell Tapper
Baush Radial Tapper
No. 307 Barnes Hone
Model H-7 Micromatic Vert,. Hone, 1 Spdl.
Model 200 Micromatic Horiz. Hone, 1 Spdl.
Model H-2 Micromatic Horiz. Hone, 2 Spdl.
14' Niles-Bement-Pond Roll
Am. Chip Wringers (New) 3.3 to 12.6 bushel capacity

PLANERS

36"x36"x12' Cincinnati, 2 hds.
36"x36"x12' Gray, 2 Hds.
42"x42"x10' Cincinnati 2 hds.
48"x36"x14' Gray
48"x48"x12' Cincinnati, 4 Heads

C-3

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GISHOLT 3R Turret Lathe—1943, 26" swing, 5¼" hole in spindle, Timken.
ACME GRIDLEY Model R-4-1-⅜", threading, serial #33,674.
ACME GRIDLEY Model F-4-1-¾", serial #6400.
2—BROWN & SHARPE #33-48" Plain Automatic Milling Machines.
CINCINNATI 48" Plain Automatic Milling Machine.
HEALD 72A3 Sizematic Grinder.
HEALD 72A Gagematic Grinder.
SIDNEY 16" x 54" Herringbone Geared Head Lathe, T.A. rebuilt.
HENDEY 20"x6' Tie Bar Head Lathe, T.A. Turner Drive, rebuilt.
CINCINNATI BICKFORD 4' Radial Drill, tapping reverse, gear box drive, reconditioned—$3000.00.
BRIDGEPORT 36" Boring Mill, 2 heads on rail, Micro Speed Drive, AC motor, reconditioned—$3000.00.

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42" BULLARD Spiral Drive Vertical Turret Lathe, serial 23,950, new 1945, equal to new

No. 3A WARNER & SWASEY Saddle Type Turret Lathe, serial 571000, new 1941

No. 3 WARNER & SWASEY Ram Type Universal Turret Lathe, serial 529000, new 1940, bar feed & tooling

24"x21' bed LODGE & SHIPLEY Selective Geared Head Lathe, 2 carriages, 25 HP motor, new 1941

4" bar LUCAS Table Type Horizontal Boring Mill, new 1941

100" BERTRAM (Niles Patterns) Vertical Boring Mill, 2 heads on rail, rapid traverse, motor drive, new 1932

Model 130 CLEVELAND Rigidhobber, new 1942, practically new condition

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1825 NIAGARA ST. BUFFALO N.Y.

MACHINERY FOR SALE

MOLINE 3 Spindle Boring Machine
EX-CELL-O #54 Two-way Boring Machine
GRINDERS—All Late Models
NORTON Type C, Semi-Automatic, 6x18
NORTON Type C, Semi-Automatic, 10x48
LANDIS Type C, Plain, 6x18
CINCINNATI Type EA, 10x18 (Inlsed)

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High Speed and Semi-High Speed

Size	Price Doz.	Size	Price Doz.
A-1	$6.00	M-1	$18.00
C-2	6.00	M-2	18.00
D-1	6.00	N-1	24.00
E-1	6.00	N-2	24.00
E-2	6.00	C-2	2.00
F-1	9.00	E-1	2.50
F-2	9.00	F-1	3.00
J-1	13.50	F-2	3.00
J-2	13.50		

VICTOR MACHINERY EXCHANGE, Inc.
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Canal 6-5575

GUARANTEED EQUIPMENT

IMMEDIATE DELIVERY

BORING MILLS

Bullard 24", VTL New Era
Cleveland 2½" Bar Cap.
Giddings & Lewis No. 0, 3" cap.
Giddings & Lewis No. 32, 3⅛" cap.
King 42" & 72" Vert. 2 rail heads
Niles-Bement-Pond 4" Bar
Niles-Bement-Pond 4½" Bar
Niles-Bement-Pond 60" Vert.

DRILLS AND RADIALS

Buffalo #2 Motor Spindle
Cincinnati Bickford 6' x 13" col.
Sibley 28" B.G.

ENGRAVERS

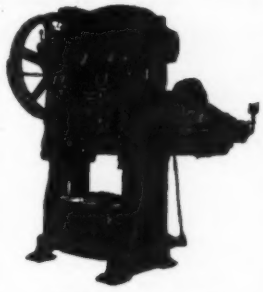
Auto Engravers Bench Type
Gorton #1A 2 Dimensional
Gorton #3B 3 Dimensional
Gorton 3L 3 Dimensional
Deckel G1L
Deckel GK2 Type 3 Dimensional, New

GEAR EQUIPMENT

Barber-Colman #12 Hobber (2)
Brown & Sharpe #13 Cutter
Fellows High Speed Shapers 712, 72, 725
Flather 72" Cutter
Gleason 3" Straight Bevel Generator
Gleason #4 Angular Bevel Tester
Gleason #2 Surface Hardener
Gould & Eberhardt 36" Cutter
National Broach Red Ring Lapper
Schuchardt & Schutte #1 Hobber

GRINDERS, MISCELLANEOUS

Cinn. 12x48" Univ. Filmatic
Covel #91A Univ. Tool & Cutter, Hammond #4
Grenby Int. IG-12, G2
Heald #73 Internal
Heald #81 Internal Gagematic
Heald 72A3 Int. Centerless Sizematic, #1 Tool
Landis 12"x36" Univ., Latest
Landis 6"x30" Type C Cyl.
Majestic Internal
Norton 6"x18", 6"x30" Type C cyl., 10x18"
Norton 14"x48" Type C Univ.
Norton Roll Grinder 50"x28'
Oliver #510 Drill Pointer, Sellers 4G, 6G, Black Diamond
Portable Cable Belt WG8, G8 Grenby Int.
Pratt & Whitney Radius #R6, K.O. Lee Tool



407A Bliss Dble. Action Dble. Crank Toggle Press

GRINDERS, SURFACE

Abrasive 3B 8x24", #33, #34 Vert.
Blanchard #16, 30" Mag. Chuck
G & L #45 12"x24" Hyd. Feed, #5 10"x36"
Heald 22—12" chuck, Arter 12"
Norton 10"x36" Hyd.
Pratt & Whitney 12x36" Vert.
Reid 11x36 Motor in Base
Thompson Hyd. 6x10x18", 6x12x18"

LATHES

American 20"x8' Bed G.H. Lathe
L & S #2A Duamatic, Like New, #3 Duomatics
Hardinge Precision 9", 1" Collet Cap., Rivett
Hendey 14" Yoke Head Lathes
LeBlond Regal 10"x3' bed
Monarch 10"x20" EE Latest (5)
Putnam 36"x22'
Putnam 42"x17'
Sebastian 12"x4' G.H.
Wickes 32"x35' Geared Head

MILLS, PLAIN, UNIVERSAL & PROD.

Brown & Sharpe #000, 21
Burke #4 Plain & Univ. Vert. Hd.
Cinn. 08 PL—Rise & Fall
Cincinnati, 1M Univ.
Kent Owens IV, IM
Sundstrand 00, 0 Rigidmil

MILLS, VERTICAL

Brown & Sharpe #3 single pulley drive
Cincinnati #4, 08 Vert. #2, 3, SPD
Morey #12M Profiler, 2 sp.
Pratt & Whitney #12B Profiler 2 Sp.

PRESSES

Bliss 645, 650 Hi-Production Presses
Bliss 18, OBI, 58, 62, 162 OB.
Bliss 4½ Double Action, Roll Feeds, Cam (2)
Bliss #78½, 330 SS
Bliss 3½A Double Action Toggle
Ferracute EG54, 400 Ton Knuckle
Niagara Horning

HYDRAULIC EQUIPMENT

SELF CONTAINED PRESSES

500 ton Shaft Straightener 24' Long Bed. Watson Stillman
125 Ton Southwark Press, Bed 96"x30". 30" stroke, 2 to 4 ft. opening
80 Ton Wilson Press, 51"x24" Platen, 11½" St. 13" opening
50 Ton William & White, 20" St. 54"x 20" Bed—24" opening
35 Ton Oil Gear Straightener
50 Ton Stokes Molding Press

MISCELLANEOUS PRESSES

550 Ton Southwark, 42"x32" Platen 28" St. 48" opening
300 Ton Watson Stillman 24x20" Platen 11" St. 21" opening

All Hydraulic Equipment is completely engineered and checked by a competent staff, thus assuring reliability. Send us your Hydraulic problems.

NEW IN STOCK

Air Hydraulic Presses—Arbor Presses #6C Famco — Band Saws Kalamazoo — Drill Presses all sizes—Hydraulic Press Northern 20 Ton—Injection Molders, 1 ounce—Power Presses, OBI, 1, 4½, 5, 7½, 10, 15, 20, 30 ton—Shaper, 7" Amco, 8" Shaperite—Shaper, Sheldon 12"—Shears, Foot 22" to 8', 16 & 18 ga.—Shears, Power, 3'x18 gauge to 10'x 10 ga.—Welders, Arc, Seam, Spot all sizes—Vert. Milling Attach. Halco H.S. —Motors, Grinders, Buffers, all sizes, etc.

Niagara A1¾, O.B.I.
Toledo 400 Ton Knuckle Joint #663
Toledo 29 Double Action Cam
V. & O. #102 O.B.I. Reducing

TURRET LATHES

Acme 6W Fox
Brown & Sharpe, #1, 2 Hand, #10, 11
Denver, 6, 2" Shell Turret (3)
Gisholt, 2L, Foster #3B
Jones & Lamson 2½" Saddle Univ.
#4R Libby 2" Cap. Univ.
Oster 601 WD. #2 Simmons Microspeed
Warner & Swasey #1A, 2A, #4 Univ.
Warner & Swasey #2 G.H. Late (4)

MISCELLANEOUS

Automatic 8 & 5 #00G
Automatic 4 Sp. 1½" Cone Acme
Band Saw: DoAll Zephyr 36"
Band Saw: #8 Marvel Like New
Filers—DoAll Band Filer
Filers—Grob Band Filer
Hacksaw: Marvel #6, #9; Peerless 6"x6"
Honer: Micromatic #H-1
Keyseater: Davis, Baker, M & M
Welder: 50 KVA Eisler Air Operated
Welder: Taylor-Winfield 50 KVA H1-Wave

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Eastern Rebuilt Machine Tools

THE SIGN OF QUALITY—THE MARK OF DEPENDABILITY

ENGINE LATHES

12x24" LeBlond Regal Geared Head, m.d.
12x30" centers Monarch Geared Head, m.d.
12"x6' Lodge & Shipley Geared Head, m.d., taper
13x30" centers Pratt & Whitney Model D, m.d. taper
14"x6' bed Hendey Geared Head, m.d., taper
14"x6' Lodge & Shipley Geared Head, m.d.
14"x6' Pratt & Whitney, cone
14"x6' LeBlond, cone
14"x6' Sidney Geared Head, m.d.
14"x6' Springfield Geared Head, m.d., taper
14"x8' Prentice, m.d., taper
14"x8' Pratt & Whitney, cone
14"x8' Sidney G.H., m.d.
15"x6' LeBlond Geared Head, m.d.
16"x30" Pratt & Whitney Geared Head, m.d.
16"x58" centers Pratt & Whitney, cone, motorized
16"x6' Bradford, cone
16"x6' Hendey Geared Head, m.d.
16"x6' Hendey Yoke Head, taper
16"x6' LeBlond, cone
16"x6' Lodge & Shipley Selec. Head, m.d.
16"x6' Lodge & Shipley, cone
16"x6' bed Monarch Geared Head, m.d.
16"x8' Lodge & Shipley, cone, motorized
16"x8' Lodge & Shipley Geared Head, m.d. in leg, taper
16"x8' Sebastian, cone
17"x6' LeBlond Geared Head, m.d.
18"x48" centers Lodge & Shipley, m.d., taper
18"x6' LeBlond Geared Head, m.d.
18"x6' bed Lodge & Shipley, cone, motorized
18"x6' Monarch Geared Head, m.d.
18"x6'6" Greaves-Klusman Geared Head, m.d. in leg
18"x7' Hendey Geared Head, m.d., taper
18"x8' American Geared Head, m.d.
18"x8' bed Boye & Emmes, m.d., taper
18"x8' Hendey Geared Head, m.d.
18"x8' Lodge & Shipley Selec. Head, m.d.
18"x8' Lodge & Shipley, cone
18"x8' Champion, cone
18"x8' Whitcomb-Blaisdell Geared Head
18"x10' Bradford, cone, motorized
18"x10' Greaves-Klusman, cone, motorized
18"x12' centers American High Duty Geared Head, m.d., late type
19"x8' LeBlond, cone
19"x8' bed LeBlond Geared Head, m.d
20"x48" centers LeBlond Geared Head, m.d., latest
20"x8' American Geared Head, m.d., taper
20"x8' Cisco, cone
20"x8' Greaves-Klusman G.H., m.d. in leg
20"x10' Sidney Geared Head, m.d.
22"x70" centers Greaves-Klusman Geared Head, m.d., taper
22"x8" Lodge & Shipley, cone
22"x10' centers American Geared Head, m.d. in base, late type
22"x10'6" Greaves-Klusman, cone, motorized
22"x14' bed American H.D., m.d., taper, late type
23"x12' LeBlond Geared Head, m.d., taper
24"x10' American, cone
24"x10' Greaves-Klusman Geared Head, m.d., taper
24"x10' Lodge & Shipley, cone
24"x12' Bridgeford Geared Head, m.d., taper
24"x12' LeBlond, cone
24"x18' Lodge & Shipley Selective Head, m.d.
25"x10' LeBlond, cone
26"x8' Bridgeford Geared Head, m.d.
27"x10' centers American Geared Head, m.d., taper
30"x12'6" Niles-Bement-Pond, m.d., taper
30"x13'6" Niles-Bement-Pond, m.d.
33"x12' Greaves-Klusman, cone, motorized, taper
36"x36'6" Niles Heavy Duty, m.d., latest, 2 carriages
36"x58' American Triple Geared Internal Face Plate Drive, m.d., taper
48"x12' bed American, m.d.

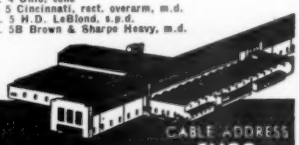
MANUFACTURING TYPE MILLING MACHINES

No. 0 Sundstrand Rigidmill, m.d.
No. 00 Sundstrand Rigidmill, m.d.
No. 12 Brown & Sharpe, m.d.
No. 1-12 Cincinnati, m.d., latest
3A Sundstrand Copy Rigidmill, m.d.

48" Cincinnati Automatic Duplex, m.d.
No. 34-36 Cincinnati Duplex Hydromatic, m.d., with tracer control, latest
No. 34-36 Cincinnati Plain Hydromatic, m.d., with tracer control, latest
No. 4-48" Cincinnati Plain Hydromatic, m.d. in base with tracer control, latest
No. 58-72 Cincinnati Duplex Hydromatic, m.d., latest
No. 58-90 Cincinnati Duplex Hydromatic, m.d., latest
Type P Ohio Mfg., m.d.
Sundstrand Rigidmill, m.d.
4" Pratt & Whitney Spline, m.d.
No. 33 Kempsmith, s.p.d.
18", 24" Cincinnati Plain Automatic, m.d.
24" Cincinnati Duplex Automatic, m.d.
30"x36"x12' Ingersoll Slab Milling Machine, 2 heads, m.d.
48"x48"x20' Ingersoll Fixed Rail Milling Machine, for tank work
Carter & Hakes, m.d.

PLAIN MILLING MACHINES

No. 1A Milwaukee, m.d.
No. 1M Cincinnati, m.d.
No. 1½, 2, 3 Cincinnati, cone
No. 2 Cincinnati Plain H.P., belted m.d.
No. 2 Rockford, m.d.
No. 2G LeBlond, belted m.d.
No. 2M Cincinnati, m.d. in base
No. 3 Cincinnati H.P., m.d., p.r.t., late type
No. 3, 4 Kempsmith Maxi-Miller, m.d.
No. 3B Milwaukee, m.d.
No. 3 Van Norman Duplex, s.p.d.
No. 4 Cincinnati H.P., m.d.
No. 4 Ohio, cone
No. 5 Cincinnati, rect. overarm, m.d.
No. 5 H.D. LeBlond, s.p.d.
No. 5B Brown & Sharpe Heavy, m.d.



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Lathe, Engine, Mackintosh-Hemphill, 72"/110"x30' centers, factory rebuilt, like new; Weight 90 Ton.

Turret—Midland #5, bar & chucker
Turret—Oster #601WD, 1½" collet
Shear—Sq., Famco Power 36"x18 G, New
Shear—Sq., Pexto 10'x10 G.
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12'x¼" DREIS & KRUMP. AC MOTOR DRIVE.

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New Landis 10x36 plain hydraulic cylindrical grinder
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Seneca Falls lo swing lathe 4x36
Seneca Falls R-14 production lathe
2 Seneca Falls IMP lathes
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Fellows #61A hi speed gear shaper
Fellows #8M Red Liner gear checker
Red Ring gear lapper
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Bliss #305 SS geared press

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GRINDER—Heald #22 Rot. Surf. 12"
GRINDER—Heald #72A3 Univ. Internal
GRINDER—Heald #72A5 Internal
GRINDER—Heald #81 Int. Chucking
GRINDERS—Milwaukee Face Mill, "C"
GRINDER, THREAD—J&L 6"x3" Int.
GRINDER, THREAD—Excello #35L
LATHE—Sundstrand 8" Auto. Stub
LATHE—Putnam 18/36 Gap, 7'-11' c-c
LATHE, TURRET—W&S #2 Electric
LATHE, TURRET—Simmons #2 Micro Speed
MILLER—Cincinnati #3-24 Hydromatic
MILLER—Taylor Fenn M-80 Spline, 4"
SCREW MACHINES—Cleveland Model "A", 1", 1-1/16" & 2"

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#35L Excello
THREAD GRINDER
Excellent Condition
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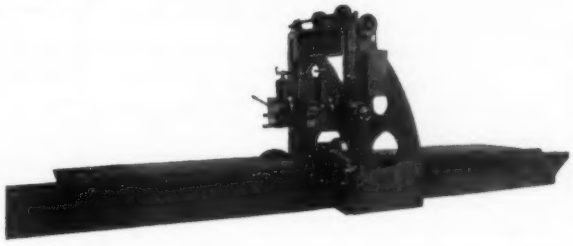
FOR PRODUCTION—PLANERS

72" x 72" x 36' BETTS DOUBLE HOUSING PLANER

Distance between housings 73"
Maximum distance face of table to bottom of rail 74"; min. 13"
Table 42' overall x 60" wide
Bed 62' overall
Two heads on cross rail
Two side heads, one on each side
Arranged for geared motor drive with 25 H.P. 230 volt, 250/1000 R.P.M. D.C. Gen. Elec. motor
With 2 H.P. D.C. motor for power raise and lower of rail



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42" x 42" x 12' Cleveland — Openside, 2RH, 1SH
56" x 56" x 10' Liberty — Openside, 2RH, 1SH
48" x 48" x 10' Niles Bement Pond—D.H., 4 Heads
50" x 50" x 16' Cincinnati — D.H., 4 Heads
72" x 56" x 24' Cincinnati D.H., 2 R.H.
72" x 72" x 36' Betts — D.H., 4 Heads
84" x 84" x 24' Putnam — D.H., 4 Heads

SLOTTERS

6" Jones
6" Newton
18" Putnam
26" Betts
36" Niles Bement Pond

30" x 24" x 6' LIBERTY DOUBLE HOUSING PLANER

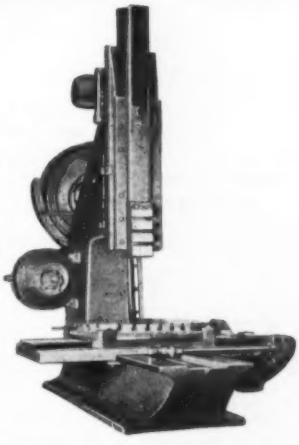
Box table 25½"x73"x7" thick
One rail head
One side head
Between uprights 30"; max. under rail 24¼"

24" x 24" x 6' LIBERTY OPENSIDE PLANER

Equipped with one head on rail
Equipped with one side head
Box table working surface 21¼" x 72"
Max. distance rail to table 24"
Motor drive with motor and controls
Weight approx. 13,500 lbs.

36" NILES BEMENT POND SLOTTER

Maximum actual stroke 39"
Maximum working stroke 32"
Diameter of rotary table 60"
Cross traverse of table 60"
Longitudinal traverse of table 60"
Front of tool apron to frame 48"
Maximum table to frame 31¾"
Minimum table to cutter bar guides 16½"
Maximum table to cutter bar 72"
Arranged for geared motor drive with 20 H.P. Westinghouse D.C. motor, 230 volts, 400 to 1600 R.P.M.



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MODEL 226-30 BESLEY OPPOSED DISC GRINDER
Dia. of wheels 30". Max. opening between wheels 28". Friction Power Feed. Two (2) 20 H.P. motors and coolant.

YODER M-31 CAM OPERATED BENDER
Designed to bend inconsistent or irregular sweeps longitudinally in extruded or roll formed sections. Automatic and hand controls of bending shoe. Roll spindle dia. 3". 10 HP variable speed drive.

KANE & ROACH MODEL ILS BENDER
Designed to bend stock up to 12" wide within limits of machine. Pyramid Type arrangement. Roll shafts 3" dia. Will take rolls for flat, angles, special shapes, etc. 5 HP motor drive.

No. 6 DEFIANCE 4½" BORING MILL
Table 42"x75". Maximum distance from table to spindle 60". Max. distance from spindle to outboard support 120". 10 spindle speeds. 12 feeds. 10 HP motor drive.

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work cap. approx. 12" dia. Single or Multiple Grinding Wheel cap. up to 36" dia. x 36" wide. Filmatic Bearings.

SUPER SPEED PRESSES
Made by Ferracute Machine Co. 10 & 30 ton (2 available). Adjustable stroke. Infeed and outfeed rolls. Variable speed drive. Designed for extremely high production of blanked and shallow formed parts.

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No. 645B Bliss. 65 ton cap. Double Crank. Tie Rod Construction. 1" stroke. Bed area 36"x18½". Shut height 10"; Infeed and outfeed rolls. Scrap cutter. 5 HP motor drive.

THREAD GRINDER
No. 101 Sheffield Precision Thread and Form Grinder. Capacity: 7" dia. x 12" length. Uses crusher roll to true grinding wheel.

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Six (6) Handmills converted to hydraulic longitudinal table feed. Hydraulic cylinder on each Mill with Vickers controls. One pump furnishes pressure for all six mills. Each spindle driven by 1 HP motor.

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GRINDERS

No. 5 B & S. cyl. 3"x18" Late.
No. 1 B & S. Univ., Equipped, Late.
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Wicaco, Internal, Late.

TURRET LATHES

No. 1 B & S. Hand Screw, Late.
No. 2 B & S. Hand Screw, P.F.M.D.
No. 2B Simmons Micro Spd., Late.
No. 3L Gisholt 4⅝" Hole in Spind. Chuck, M.D.
Bullard 24" Vertical, New Era, M.D.

PRESSES, Bliss #1018, 1028 Auto. comb. feed 4 & 5 Sta. Draw ¾"-1¼" deep.

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Baush 44" Hvy. Duty Vert. Boring Mill, 2 Hds.
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Cin-Bick 3' & Morris 3½' Arm Radial Drills
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B & S No. 2-A & 3-A, Mill, No. 2-B, Cin. No. 1-M, Cin. No. 2 Grd. Hd. Univ. Millers
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Cleveland 48" x 12" Table Openside Planer, 3 Hds.

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#4B B & S Horizontal Milling Machine
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150 Amp. GENERAL ELECTRIC Arc Welder
400 Amp. HORNET Arc Welder
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1" PINES Bender, air operated
8'x 12 gauge D & K Leaf Brake
72" MOULDERS FRIEND Sand Cutter
1000 ton BIRDSBORO Hydraulic Press
#29 WILLIAMS & WHITE Bulldozer

NEW MACHINES

30 KVA REX Spot Welder
15 KVA REX Spot Welder
15 ton WIANT Arbor Press
#15 BUFFALO Drill Press
#18D BUFFALO Drill Press
12 x 48 SHELDON Lathe
11 x 36 SHELDON Lathe
#5 JOHNSON OBI Punch Press
#3 JOHNSON OBI Punch Press

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Blanchard Automatic Rotary Surface Grinder 30" Ring, Automatic Chuck with 30 h.p. Motor and Pump, Demagnitizer, Dresser, Automatic Takeoff, etc. Rebuilt 1944, unused since.

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90"x20' Putnam, Sw. 94", Internal Geared Face Plate Drive.
72"x14' New Haven, Internal Geared Face Plate Drive.
60"x40' Pond, Internal Geared Face Plate Drive.
60"x14' Miles, Internal Geared Face Plate Drive.
50"x30' American Geared Head, Quick Change, Internal Geared Face Plate Drive, Motor Driven.
48"x28' New Haven, Swings 102", with Raising Blocks.
48"x18' Fitchburg, Internal Geared Face Plate Drive.
38"x22' Gleason, Internal Geared Face Plate Drive.
36"x32' Schumacher & Boye Geared Head, Quick Change, AC Motor Drive.
36"x28' Pond, Internal Geared Face Plate Drive.
36"x16' Putnam Geared Head, Direct Geared Motor Drive, Internal Geared Face Plate Drive.
36"x16' Putman, Internal Geared Face Plate Drive.
36"x14' Niles-Bement-Pond Geared Head, Quick Change, AC M.D., Internal Geared Face Plate Drive.
34"x9' Putman, AC Motor Drive.
32"x14' Boye & Emmes Quick Change, AC Motor Drive.
33"x20' Bridgeford Geared Head, Quick Change, AC Motor Drive.
30"x30' Lodge & Shipley Geared Head, Quick Change, AC Motor Drive.
28"x12' Schumacher & Boye Back Geared.
27"x18' Greaves-Klusman Quick Change, AC M.D.
26"x20' Davis, AC Motor Drive.
24"-48" x 18' J. J. McCabe Double Spindle.
24"x19' Prentice Geared Head, Motor Driven.
24"x16' LeBlond Quick Change, AC Motor Drive.
24"x14' LeBlond Quick Change, AC Motor Drive.
24"x12' Bradford Geared Head, Quick Change, Taper Attachment.
24"x10' CC. Boye & Emmes Geared Head, Q.C., Timk. Bearings, AC Motor in Base.
20"x18' American Geared Head, Quick Change, AC Motor Drive, Taper Attachment.
20"x17' Reed-Prentice Geared Head, Quick Change, Taper Attachment.
20"x10' Reed-Prentice, Geared Head, Taper Attachment.
20"x8' Lodge & Shipley Geared Head, Quick Change, AC Motor Drive.
20"x8' Hendey Geared Head, Q.C., AC Motor in Base, Taper Attach.
20"x8' Reed-Prentice Geared Head, Q.C., AC Motor in Base, Taper Attach.

GAP LATHES

22"x46"x8' Fitchburg, Sliding Bed.
18"x36"x6' Fay & Scott, Sliding Bed.
18"x30"x8' LeBlond, Quick Change, Motor Driven.

COMBINATION PUNCH & SHEARS

Model "B" Long & Allstatter Extra Heavy Duty Double End.
#20 Pels Triple Combination Punch & Shear
#16 Pels Triple Combination Punch & Shear, Notcher.
#91-16 Scantag Triple Combination Punch & Shear, Notcher.
#25-U Buffalo Triple Combination Punch & Shear.
#½ Buffalo Triple Combination Punch & Shear, Notcher.
Wais & Roos Double End Punch.
#10 Pels Triple Combination Punch & Shear, Ratchet Type.
#23-HU Buffalo Triple Combination Punch & Shear, Ratchet Type.

POWER PRESSES

#74½ Bliss, Straight Side, Geared, Side Trimming Attachment, with AC Motor.
#73½ Bliss Straight Side, Gap Type, Motor Driven with AC Motor.
#37 Excelsior Double Crank Press, AC Motor.
#30 Bliss Arch Press, AC Motor.
#P-5 Ferracute Back Wheel Press, AC Motor Drive.
#P-4 Ferracute Back Wheel Press, AC Motor Drive.
#21 Bliss Open Back Inclinable, AC Motor.
#20-B Bliss, Open Back Inclinable, AC Motor.
#20-C Bliss, Open Back Inclinable, AC Motor.
#19 Bliss, Open Back Inclinable, AC Motor.
#3 V & O Open Back Inclinable, AC Motor Drive.
#3 Niagara, Open Back Inclinable, AC Motor.
#A-2 Niagara, Open Back Inclinable, AC Motor Drive.
#A-1¾ Niagara, Open Back Inclinable, AC Motor.
#C-4 Ferracute, Open Back Inclinable, AC Motor.
#12½ Toledo Horning Press, Swivel Table, AC Motor Drive.
Merrill Heavy Duty Knuckle Joint Press, AC Motor.
#P-42 Ferracute Gap Type Press, AC Motor Drive, 42" Throat.

SINGLE END PUNCHES

#3 Hilles & Jones Extra Heavy Duty Geared Punch, 42" Throat.
Cleveland 30" Throat, Geared Punch, Heavy Duty.
#5 Long & Allstatter Punch, 42" Throat.
P-42 Ferracute Punch, 42" Throat.
21" Throat, Heavy Duty Geared Punch.

ANGLE SHEARS

#14 Pels Shear for Angles, Tees, Rounds, Squares and Channels, All Steel Armor Plate, Many Knives.
6"x6" Geared Angle Shear.

POWER SHEARS

10' 10 Gauge Niagara Late Model.
8' 1/4" Chicago, All Steel Armor Plate, 18" Gap.
10' George Ohl.

POWER BENDING ROLLS

10'x½" Hilles & Jones Power Bending Roll, Open End, AC Motor Drive.
50" Slip Roll, Geared, 4" Diameter Rolls, Open End.

MILLING MACHINES

#4 Cincinnati Plain and Vert.
#4B Milwaukee Plain.
#3B Milwaukee Plain and Univ.
#3 Kempsmith Maximiller, Plain, Motor in Base.
#3 Cincinnati Plain and Univ., Motor in Base.
#2H Milwaukee, Univ., Motor in Base.
#2B Brown & Sharpe Light Type, Univ., Motor in Base.
#1 Cincinnati, Brown & Sharpe, Cleveland, Univ. and Plain.
#22LU Van Norman Univ., Motor in Base.
#2 Van Norman Duplex.
#12 Van Norman.
#6 Van Norman.

BORING MILLS

42" King Vertical, Side Head, Late.
60" Colburn Vertical, 2 Heads.
#31 Lucas, 3", Horizontal.

RADIAL DRILLS

3'8" American, Hole-Wizard, Motor on Arm.
4'9" Cincinnati-Gilbert, Motor on Arm.
4'8" Cincinnati-Bickford, Motor Driven.
4'13" Cincinnati-Bickford Super Service, Motor on Arm.
5'13" Dreses, Motor Driven.
6'17" American Triple Purpose, Motor Driven.

TURRET LATHES

#2L Gisholt Geared Head.
#4 Warner & Swasey, Geared Head, Motor in Base.
#4 Foster.
#4 Bardons & Oliver.
1" Pratt & Whitney.

SURFACE GRINDERS

#A-1-12 Arter Rotary, AC Motor Drive.
#3B Abrasive, Motor in Base, 8"x24".
22"x8"x12" Abrasive, Motor in Base.
#2 Brown & Sharpe, Motor in Base.

CUT-OFF MACHINES

Type J Radiac, 10 HP.
M-2 Tannewitz, 2 HP.
Pasco, 5 HP.
DeWalt, 10 HP.

KEYSEATERS

#0 Baker.
#1 Newton, Vert. & Horiz.

TAPPERS

#1A Haskins.
#2X Garvin.

PLANERS

48"x10' Cleveland, Openside, Side Head, M.D.
30"x30"x10' Gray, 2 Heads, M.D.
30"x30"x8' Pond, M.D.

GEAR CUTTERS

Newark, 60" Dia. Pitch x 15" Face.

WELDERS

75 KVA Spot, Thompson Gibb, Press Type, with Timer and Controls, AC Motor Drive.

POWER PRESS BRAKES

10' George Ohl, AC Motor on Arm, Geared.

FRICTION SAWS

48" Ryerson, Motor Driven with AC Motor.

THREAD MILLERS

#32 Murchey, Internal and External, Left & Right Hand, AC Motor in Base.

PARTIAL LIST: Many more machines available in all types and all sizes.

GLOBE MACHINERY COMPANY

214 CENTRE STREET **Phones: CAnal 6-8026-8027** **NEW YORK 13, N. Y.**

SEARCHLIGHT SECTION

AUTOMATICS
⅞"-1 1/16" Cleveland 4 spdl.
2" Model B 18" Cleveland
3½" Cone 4 spindle
No. 454 New Britain Chucking
14"x19" Fay

BORING MILLS
51" Bullard old style
84" Gisholt
100" Niles-Bement-Pond
2½" Cleveland horiz., long bed
3" Rockford
4" Detrick & Harvey floor type
5" Jones planer table type
No. 5D Moline 6 spdl. cylinder bore

DRILLS
21" & 24" Cincinnati
Nos. 121, 217, 310 & 315 Baker
Barnes horizontal radial
3' Carlton sensitive radial
4' Cinc. Bickford univ. radial
6'-15" Dreses radial
16 spindle No. 13 Natco multiple
34 spindle No. 30 Natco multiple
4 spindle No. 4 Foote Burt rail
6 spindle No. 17 Foote Burt rail

GEAR CUTTERS
Nos. 6 & 7125A Fellows shapers
Nos. 8H, 12H, 16HS & 18H G. & E. hobbers
No. 130 Cleveland Rigidhobber
No. 5A Lees Bradner hobber
4" Gleason spiral bevel
36" Gleason bevel planer
Gleason testers & lappers
Illinois involute tester

GRINDERS, CYLINDRICAL
6"x18", 10"x18" & 14"x36" Landis hydraulic
10"x24" & 16"x72" Landis mechanical
14"x36" Landis hydraulic universal
10"x36" Norton semi-automatic
10"x18", 10"x30" & 10"x50" Norton mech.

GRINDERS, INTERNAL
No. 75A Heald hand feed
Nos. 72A3 & 72A5 Heald
No. 72A3 Heald, cross slid, head
No. 72A3 Heald Sizematic
Model MH1 Sav-Way
Grenby bench type

GRINDERS, SURFACE
Nos. 10 & 16A2 Blanchard rotary
12" & 16", No. 22 Heald rotary
8" Pratt & Whitney rotary (tub)
8"x24" No. 34 Abrasive vertical
14"x36" Pratt & Whitney vertical
8"x24", No. 78 Wilmarth & Morman
8"x22", No. 3 Abrasive

MILLERS
No. 2A & 2AS Milwaukee
No. 2 Cincinnati, horiz. & vertical
No. 3 Ohio
12" Cincinnati Plain Mfg.
No. 1H-12" Kearney & Trecker
18" & 24" Cincinnati plain automatic
18", 24" & 48" Cincinnati duplex
No. 31 De Vlieg Supermil
No. 1-8 Kent Owens hydraulic
Nos. 1, 2 & 3 Kent Owens hand
No. 1 Kent Owens semi-automatic
20"x84" table Ingersoll vertical
Ingersoll Rise & Fall
6 spindle Moline profiler
24"x18"x14' Ingersoll planer
48"x24"x22' Ingersoll planer
30" Newton rotary
30", 42" & 84" Ingersoll rotary

SHAPERS & PLANERS
20" G. & E. shapers
24" Columbia univ. shaper
16" Bement Miles slotter
30"x24"x6' Liberty openside planer
36"x36"x8' Gray planer
48"x48"x12' Cleveland openside planer

MILES MACHINERY CO.
Box 770 SAGINAW, MICH.

BETTER PERFORMANCE at Lower Cost

LATHES
LEBLOND #2 Gun Boring Lathe—(1942 vintage) used on 37 MM shells—swing over bed 18½"—hole thru spindle 5⅛"—10' stroke (excellent condition).

NILES-BEMENT-POND 48"x30' centers — quick change gr.—gr. hd.—heavy duty; AC motor drive—2 carriages—taper attachment—power rapid traverse—16 speeds—2.04 to 90 RPM—(late type).

PRATT & WHITNEY Model "B" 18"x36" Motor-in-base

AMERICAN 16"x6' and 18"x8', 12-speed, Gr. Hd. Pan Bed, M.D.

TURRET LATHES
WARNER & SWASEY #4 Pre-selector head—bar & chucking—spindle 2-7/16"

WARNER & SWASEY #2A—Timken bearing—chucking—capacity 3½"

PRODUCTION LATHE
MONARCH Model "2" 14"x42" Magnamatic 12-spd. all electric, full automatic, double carriage, late, swing 14½", center distance 42"

SENECA FALLS 4"x60", 6-speed, Gr. Hd.—low-swing, M.D.—swing 9¾", center distance 60"—2 carriages

SENECA FALLS 8"x108" Lo-swing Lathe—(1942 vintage)—swing over ways 13½"—over carriage 10"—two 30" power feed carriages—template

PLAIN, INTERNAL & EXTERNAL GRINDERS
NORTON 6"x18" Type "C" Plain Hydr. Cylindrical, oscillating spindle, late.

NORTON 20"x120" Plain, Self-contained Cylindrical

NORTON 24"x240" Cylindrical Grinder, Type "A"

BROWN & SHARPE #2 M.D. Universal Grinder (2"x30" cap. (with atchmts)

BROWN & SHARPE #4 M.D. Universal Grinder (2"x60" cap. (with atchments)

PRESSES
U. S. 1000 Ton, Four Posted Hydraulic Hobbing Press—with pump—8" stroke—ram dia. 20"—dist. btwn. posts 20".

2—V & O #12 OBI Double Action Cam Presses—M.D. (late type)

GEAR CUTTERS
GOULD & EBERHARDT #36 M.D. auto. Spur Gear Cutter, 36" dia. x 12" face capacity.

BARBER COLMAN #12 Dble. Overarm Spur & Helical Gear Hobber, M.D., capacity 12" dia. by 10" face width—with outboard support and rapid traverse.

FELLOWS #6 Spur Gear Cutter, 35" capacity.

Send for our catalog "The PLANT that Answers 1001 Machine Tool Problems".

Botwinik Brothers of Mass., Inc.
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BORING MILL
72" Niles-Bement-Pond Vertical, with 2-swivel heads, power elevation.

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48"x34' Driggs Geared Hd., 12-speeds, takes 24' betw. centers, 3" H.S., plain change gears, with chuck jaws.

All machines in good serviceable condition and available for immediate shipment.

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EVERY ITEM GUARANTEED
All Late Type

7" Barrett Horiz. Boring Mill, Floor Type
#28/120 Cincinnati Vert. Hydrotel Mill, 3 Spdl.
#28/60 Cincinnati Vert. Hydrotel Mills, 3 and 4 Spdl. (2)

25 Ton 48" Stroke Colonial Dual Ram Vertical Surface Broach
14' Niles Vert. Boring Mill
Bullard Multaumatic 12" 6 Spdl. Type D
5'-11" Carlton Radial Drill
60" Bickford Vertical Boring Mill
75 Ton Henry & Wright Dieing Press, '41
18x96, 22x52 & 20x48 O D Grinder
#7125A Fellows Gear Shaper, High Speed

200 Ton Cleveland #60-D-84 Punch Press Dbl. Crank, 16" stroke, 46½x86" Bed.
200 Ton Verson, #40FS, Punch Press, 30" stroke, 35 x 37 bed.

Model LV Davis & Thompson Rotomatic Drill
Cone Automatic 2¼" 6 Spdl., 1941
#2 Cincinnati Tool & Cutter Grinders
Planers 48x48x10' Cin. Dbl. Housing
#3R Gisholt Turret Lathe. 5" Capacity
#R-14 Lo-swing Production Lathe
#12 Van Norman Universal Mill
#2H Kearney & Trecker Vertical Mill

#1½ Yoder Roll Former, 8 Spdl, 1½" Shaft dia. x 6½" Max. length flat strip, latest, w/cutoff
60" McKay Roller Levellers, ¼" to 2" Cap. and ½" to 2" Cap., armor plate (2)

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2—12" Gleason Straight Bevel
GEAR GENERATORS
Serial 16094 and #15715, for sale with a wide assortment of cutters. *These are in very good condition.*

JOSEPH J. MARTIN CO.
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GEAR AND SPLINE GRINDER
Type GG-35 GEARGRIND—18" External, Hyd. Table Stroke 27" New 1942—220/440/3/60 Elec.

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ATTENTION EXPORTERS!

Unusual opportunity to procure modern Fellows Gear Shapers 615A and 645 as well as 12" Gleason Generators, 36 BM Gould & Eberhardt Rougher, #7 Fellows Gear Shaper, #16 D. E. Whiten Machine. Write for full information.

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NEARLY $1,000,000.00 WORTH OF EQUIPMENT MUST BE SACRIFICED. NO REASONABLE OFFER REFUSED.

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CLEVELAND type 443 Vert. Trimming; 1½" stroke
GARRISON 132" Gate; cap. 1"
LEWIS #5½ Alligator; 5¼" stroke
LONG & ALLSTATTER type A double geared Gate
LONG & ALLSTATTER Type B double head copying
MACKINTOSH HEMPHILL Bar; stroke 3½"

PRESSES—Hydraulic

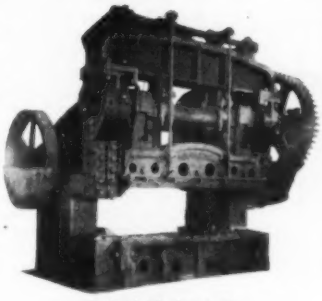
BEMENT MILES (upward) 36" stroke
BETHLEHEM (downward) 16" stroke
BETHELHEM (Downward) Flanging, 66" stroke
MACKINTOSH-HEMPHILL (upward) 30", 38", 60" strokes

PRESSES—Power

BLISS No. 10A, 450 tons, 12" stroke
BLISS No. 15, 1200 tons, 20" stroke
FERRACUTE 100 ton cap., 2" stroke
TOLEDO No. 88 single crank, 16" stroke

PUNCHES—Vertical, Open Gap

CLEVELAND type EF, 1½" stroke
CLEVELAND Type C, ½" stroke
CLEVELAND type C, 1½" stroke
COVINGTON No. 2, 54": stroke 2"
HILLES & JONES No. 2, 1½" & 1⅝" strokes
HILLES & JONES No. 3, 2½" stroke
LONG & ALLSTATTER No. 2, 1¾" stroke
LONG & ALLSTATTER No. 3, 1½, 1⅝" stroke
MACKINTOSH-HEMPHILL No. 3, stroke 2½"
MASSILLON No. 3, 1¾", 2" strokes
WILLIAMS & WHITE No. 17, cap. 1" x ⅝"



Actual Photograph
SOUTHWARK 400 ton, 7" stroke
Multiple Punch

PARTIAL LIST

Bulldozers, air compressors, hydraulic pumps, Axle Lathes, Planers, Saws, Welders, Turbines, Turbo Generators, Testing Machines, and a large quantity of SMALL TOOLS such as chain blocks, reamers, drills, cutters, etc.

PUNCHES—Multiple, Open Gap

CLEVELAND 500 ton Vert. 30" IX; 6" stroke
CLEVELAND 500 ton Vert. 30" IX, 3" stroke
CLEVELAND 24" Angle, 2½" stroke

PUNCHES—Multiple

CLEVELAND No. 1, ⅝" cap. 6" stroke
CLEVELAND 3" stroke; 120" throat
COVINGTON 10'2", stroke 6"
SOUTHWARD 400 ton, 7" stroke
THOMAS No. 20, 3" stroke, 35" throat
THOMAS No. 20, 3" stroke
WILLIAMS & WHITE Vert. 6" stroke, 36" throat

PUNCHES—Double Head, Open Gap

CLEVELAND type C, 1¼" stroke, 28" throat
HILLES & JONES No. 3, 1½", 1¾", 2" strokes
LONG & ALLSTATTER Size "B"; cap. 2¼" dia., 1¼" thick

PUNCHES—Horizontal

CLEVELAND style A.L., 1½" stroke
HILLES & JONES No. 2, 1½" stroke
HILLES & JONES No. 2, 1¼" stroke
HILLES & JONES No. 3, 1⅝" stroke

FORGING MACHINES

AJAX horiz., 1½", 2", 4", 5"
AJAX Auto. rivet forging
AJAX Lever forging, size 43"

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BEMENT MILES 18" SLOTTER with 3" dia. spindle. M.D.
KING BORING MILL 42" 2 swivel heads. 38" table. 4 chuck jaws. M.D.
GOULD & EBERHARD 40" Gear Cutter, M.D.
BROWN & SHARPE #5—48" Gear Cutter, M.D.
KEMPSMITH #4 Maxi-Miller, M.D.
BINSEE MACHINERY COMPANY HORIZONTAL BORING MILL. Table 30"x64". Quantity of boring bars.
LODGE & SHIPLEY 30"x72" c to c Geared Head, Quick Change Lathe, M.D.
CINCINNATI 60"x60"x12' Planer. 4 heads. 1 extra side head on massive floor stand for open side work. M.D.
CINCINNATI BICKFORD 7' RADIAL DRILL 17" column. M.D.
CINCINNATI BICKFORD 6' RADIAL DRILL 19" column. M.D.
LEBLOND 28"x14' QUICK CHANGE LATHE. Cone or M.D.
AMERICAN 20"x16' QUICK CHANGE GEAR LATHE. M.D. Old, but good.
BARNES HEAVY DUTY 26", 4-SPINDLE DRILL. 1 spindle for tapping. M.D. #5 M.T.
GRINDERS—CYLINDRICAL. B & S #11. 12"x 32". Plain Grinder. Table swivels. Motorized.
LANDIS 10"x36" Plain, M.D. Also Planer type Grinder 16"x36".
GRAY 32"x32"x10' PLANER. 2 swivelling heads. M.D.
"BEMENT" 26" STROKE TRAVERSING HEAD SHAPER. 48" travel to ram. 2 tables

THE OSBORNE & SEXTON MACHINERY CO.
P. O. Box 88 Columbus 16, Ohio

LATE MODEL MACHINE TOOLS . .

AUTOMATICS

20"x25" Fay Automatic. 1942.
No. 3-S Sete ⅝" Cap. 1942.

DRILLS

4' 11" Canedy Otto Radial.
No. 2 LMS Leland Gifford Hyd. 1942.

GEAR EQUIPMENT

No. 645A3 & 61A Fellows Gear Shaper. 1944.
No. 0 Gleason Revacycle. 1940.
No. 0 Gleason Gear Tester. 1942.
6" Red Ring Internal Shaver. 1942.
15" Red Ring Lapper. 1942.
Red Ring Universal Tester. 1942.

GRINDERS, CYLINDRICAL

14"x108" Norton Plain Type O. 1942.
14"x40" Norton Pl. Type O. Hyd. 1941.
14"x36" Landis Univ. Type C. Hyd. 1942.
12"x36" Norton Universal. 1941.
6"x18" No. 10 Brown & Sharpe Pl. Hyd. 1943.

GRINDERS—INTERNAL

No. 24-36 Bryant 1943.
No. 172 Heald Hyd. Gap. 1940.
No. 81 Heald Plain Hyd. 1940.
No. 75 Heald Airplane Cyl. 1942.
72A3 Heald Plain Hyd. 1942.
No. 30 Heald Hyd. 1943.

GRINDERS—THREAD

No. 35L Excello Precision. 1943.
No. TG-615 Jones & Lamson. 1942.

GUN BARREL MACHINES

No. 410 Barnes Deep Hole Drill. 1943.
No. ½Bx50 P&W Reamer. 1942.
No. ½Bx30 P&W Reamer. 1942.
No. ½Bx50 P&W Rifler. 1942.

LATHES—ENGINE

39"x196" American G.H.
20"x240" LeBlond. 1941.

LATHES—PRODUCTION

No. 3 FU Foster "Fastermatic". 1942.
14"x42" Monarch "Magnamatic". 1941.
Lips Carbo-Matic. 1942.
LeBlond Multi-Cut. Late.
No. R-14 Lo-Swing. 1941.

LATHES, TURRET

No. 4A Warner & Swasey. 1942.
No. 1A Warner & Swasey. 1938.
No. 5.0 Acme Universal. 1942.
No. 1H-6 Libby Universal. 1942.

MILLS, PRODUCTION

No. 34-36 Cincinnati Hydro. 1942.
No. 5-48 Cincinnati Hydromatic. 1942.
No. 2-20 Kent Owens. 1942.
No. 1-14 Kent Owens Hyd. 1942.
No. 0 Sundstrand Rigidmil. 1942.

MILLS, THREAD

6"x6" LT Lees Bradner. 1942.

MISCELLANEOUS

48"x½" Niles Plate Straightener.
No. 618 Cleveland Rigidturner. 1942.

SHAPERS

20" Cincinnati Plain. Late.
6" Pratt & Whitney Vertical. 1942.

WELDERS

100 KVA Taylor-Winfield Seam. 1943.

Write for latest stock list

INDIANAPOLIS *Machinery & Supply Co.*
1961 S. Meridian St. . . Indianapolis, Indiana

LATE MODEL TOOLS

LATHES

12"x30" MONARCH Model CK Toolroom Lathes
14"x54" L & S Selective Geared Head Lathe
15"x36" LeBLOND REGAL Geared Head Lathe
16"x30" MONARCH Model C Toolroom Lathe
16"x54" AMERICAN "Pacemaker" Multi-Production Lathe
16"x78" SIDNEY Geared Head Toolroom Lathe

AUTO. LATHES & TURRETS

Model ESM-59 HARDINGE Hand Screw Machine
No. 2 B & O Geared Electric Turret Lathe
12"x21" J & L (Fay) Auto. Lathes
20"x25" J & L (Fay) Auto. Lathes
No. 5DE POTTER & JOHNSTON Auto. Turret Lathes
No. 4 GISHOLT Ram Type Univ. Turret Lathe

MILLING MACHINES

No. 2HL KEARNEY & TRECKER Plain Miller
No. 2S VAN NORMAN Ram Type Univ. Miller
No. 2KM KEARNEY & TRECKER Vert. Miller
36"x36"x16' INGERSOLL Planer Type Miller
36"x36"x16' INGERSOLL Adjustable Rail Planer Type Miller, 40 HP AC Motor Drive, One Rail Head, Two Side Heads.
No. 0S CINCINNATI Plain & Vert. Auto. Millers

GRINDERS

No. 2 CINCINNATI UNIV. Tool & Cutter Grinder
6"x18" LANDIS Type C Plain Grinder
10"x18" LANDIS Type C Plain Grinder
10"x24" LANDIS Type C Universal Grinder
No. 2-1 REID Surface Grinder
6"x18" NORTON Vert. Spdle Surface Grinder
14"x16"x60" MATTISON Hyd. Surface Grinder
16"x96" LANDIS Type B Plain Cyl. with Gap Bed
No. 5 BROWN & SHARPE Pl. Cyl. Grinder, 3"x18"
No. 16/28 BRYANT Hyd. Internal Grinder
No. 174 HEALD Hyd. Gap Internal Grinder

DRILLS

No. 1LMS LELAND GIFFORD 6-spindle Drill
No. 2LMS LELAND GIFFORD 2-spindle on 4 spindle base
No. 3MS LELAND GIFFORD 2-spindle, hydraulic feed
No. H-3 BARNES Single Spindle HYDRAM Drill
3'11" MORRIS "MOR-SPEED" Radial, 27 speeds, 7½ HP

GEAR EQUIPMENT

No. 725A FELLOWS High Speed Gear Shaper
No. 145 CLEVELAND Rigid Hobber
No. 36BM GOULD & EBERHARDT Gear Rougher
No. 49H GOULD & EBERHARDT Univ. Gear Hobber

MISCELLANEOUS

18" GEMCO Shaper, M.D.
20" STEPTOE Shaper, Uiv. Tanble
No. ½B P & W Two Spindle Reaming Machine, 1944
4½"x36" PRATT & WHITNEY Model C Thread Miller
Model H-1 MICROMATIC Hydrohoner
No. 49 HEALD Precision Boring Machine, Single End
6" TAYLOR & FENN Spline Millers
⅞" CONOMATIC 4-spindle Auto. Screw Machines

Wigglesworth MACHINERY Co.
MACHINE TOOLS
203 BENT ST.
CAMBRIDGE 41
MASS.
KIRKLAND 7-5242

SCARCE MACHINE TOOLS

No. 2-24 Cincinnati R & F Automatic Mill (1946)
No. 3H Kearney & Trecker Mill, late
No. 2H Kearney & Trecker Mill, late
No. 08 Cincinnati R & F Automatic Mill, late
No. 1-12 Cincinnati Plain Automatic Mill, late
No. 10 Brown & Sharpe Automatic Mill, late
10"x18" Landis Hy. Plain Grinder, late
No. 2 Brown & Sharpe Universal Grinders, late (2)
No. 5 U Foster Turret Lathe
No. 4A Warner & Swasey G.H. Turret Lathe, ser. 292,000
No. 5 Bardons & Oliver Turret Lathe, serial 14083
12"x63" Fay Automatic Lathe, 1940
R-14 Seneca Falls Lo-Swing Aut. Prd. Lathe, 1940
8½"x8" Goss & deLeeuw Chucker
16"-17½"x84" Porter McLeod Engine Lathes, late (2)
No. 16A Gorton Swiss Type Automatic, late
4½" Model A Cleveland Automatic
No. 00, No. 0, No. 2 Brown & Sharpe H.S. Automatics
No. 252 Barnes G.H. Drill Press, late
No. 8 Marvel 18"x18" Metal Band Saw, late

MACHINE TOOLS

TELEPHONE TAylor 9-8200
LAKE MACHINERY COMPANY
942 WEST LAKE STREET • CHICAGO 7, ILLINOIS

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Classified Advertising Division

American Machinist

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CLEVELAND Mod. A1¼" & 2" Tur. Dr. $950 & $2450
CLEVELAND Mod. A7¾", Tool. Excel. 8,500
CLEVELAND Mod. B1½" good condition 850
ACME #52 ⅜", #53 ⅞", #55 1⅝" & #56 2¼", 4 spdl, complete w/tooling 1,495 up
GRIDLEY 4¼" single spdl. Tooling 2,975
GRIDLEY ⅝" 4 spdl. Mod. F (7 avail.) 1,495
B&S #19 Single spdl. ⅜" motorized 1,000
B&S #0 & #2 Ser. 3000 class, Tool 1,375 & 1,675
B&S #00G, new '40, motorized, excel. 4,250 up
WORREL 5/16" Form, cut off & dr. '43 F.M. 1,450

LATHES—GRINDERS—PRESSES, ETC.

LIBBY TURRET 4½" & 7½", comp. $995 & $1,250
DENVER TURRET 6.2, 20¼" Sw. 7½ HP. 5,000
B&S #2 Surface Gr. 18"x6" 700
No. 33 ABRASIVE Surf. Gr. Vert. 1,500
LANDIS #2 Univ. Cyl. Gr. 12"x36" 950
G&L & CIN. #1½ Univ. Tool & Cutter 775 & 1,250
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Lodge & Shipley 18"x6' Selective Geared Head
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Lodge & Shipley 18"x8' Selective Geared Head
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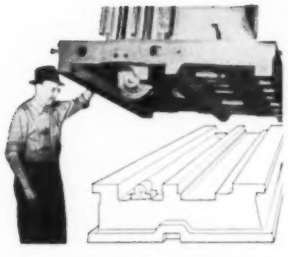
GILBERT

non-metallic ways

WIN *with* NO SCORE



At The Thompson Grinder Co., Springfield, Ohio, abrasive dust unavoidably present in the atmosphere made it pretty rough on the original cast iron ways of this Cincinnati Gilbert floor type horizontal boring mill. Six months was about the best service life obtainable before resurfacing the ways became necessary.

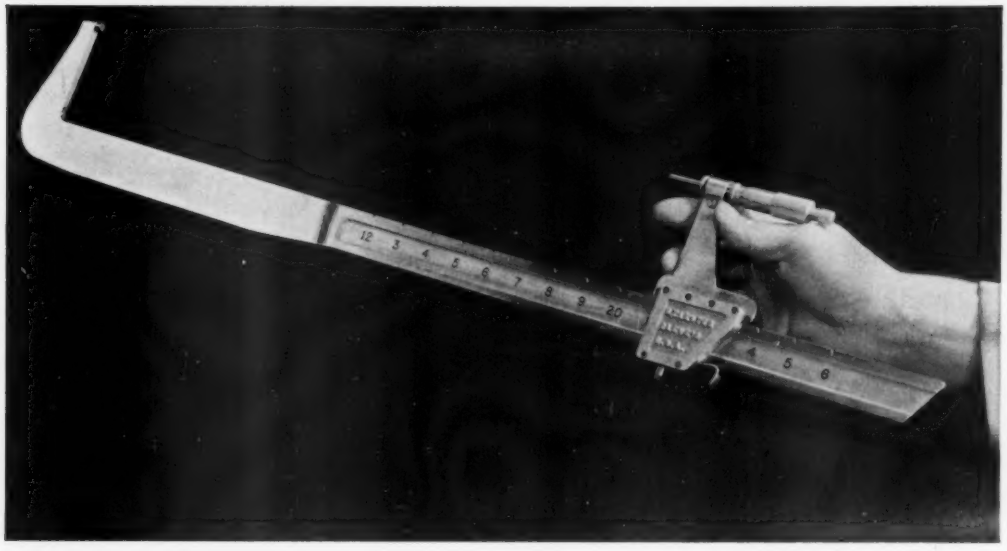
The scoring problem was completely eliminated with Cincinnati Gilbert non-metallic way blocks installed under the column base. Now, after 26 months of heavy duty service—16 hours a day, 5 days a week—the mill has maintained original accuracy—*and still no score*... This is just one of many practical reasons for specifying "Cincinnati Gilbert" on your next boring mill purchase. Write for Bulletin 1244-B... The Cincinnati Gilbert Machine Tool Company, 3366 Beekman Street, Cincinnati 23, Ohio.

THE CINCINNATI
GILBERT
MACHINE TOOL COMPANY

3366 BEEKMAN STREET, CINCINNATI 23, OHIO • RADIALS • BORING MILLS • ACCESSORIES

THOSE WHO BUY GILBERT BUY GILBERT AGAIN

How GRAPH-MO steel made a micrometer measure up



PRECISION'S the thing at the Lester Micrometer Company, Cleveland, Ohio, and a good example of it is their V-notch Adjustable Micrometer. The extreme accuracy of this instrument depends on the precise spacing of the V-notches. And the micrometer spacer must maintain a certain accuracy between the anvils. Finding a steel that would permit and maintain this precision posed a problem. The right steel for this job would have to: 1. retain its initial accuracy over a long period of years, 2. give minimum distortion from heat treating, 3. machine easily and 4. assure excellent welded characteristics for strength.

After experimenting with other steels, the engineers found the answer in Graph-Mo steel. Graph-Mo did not change size in aging, did not warp or crack during heat treating, machined easily and allowed ductile welds that did not develop cracks under shock loading.

Because Graph-Mo contains free graphite, it machines fast and easily to close tolerances. It hardens uniformly with minimum distortion and gives an extremely fine finish after polishing. And due to diamond-hard carbides in the structure, it offers unusually stubborn resistance to wear and abrasion.

Graph-Mo is one of four Timken® graphitic tool steels widely used in gauges, dies, machine parts and other applications. For further information, write for the enlarged 9th edition of the Timken Graphitic Steel Data Book. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

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Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing.